

SPECIFICATIONS

FOR

WARSAW SWING BRIDGE REPLACEMENT
TRENT-SEVERN WATERWAY NATIONAL HISTORIC SITE
PARKHILL ROAD EAST, PETERBOROUGH, ONTARIO

FOR

PARKS CANADA AGENCY
PROJECT NO. R-30027479 (RPA 859)

ISSUED FOR TENDER

BY

SNC-LAVALIN INC.
200-5657 SPRING GARDEN ROAD
HALIFAX, NOVA SCOTIA

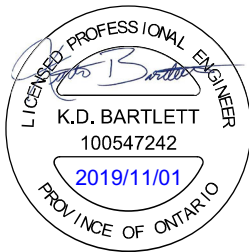
2019-11-01

SPECIFICATIONS

FOR

**WARSAW SWING BRIDGE REPLACEMENT
TRENT-SEVERN WATERWAY NATIONAL HISTORIC SITE
PARKHILL ROAD EAST, PETERBOROUGH, ONTARIO**

ISSUED FOR TENDER



KEITH BARTLETT, P. ENG.
CIVIL ENGINEER
SNC-LAVALIN INC.



SHAWN ZAHRAWI, P. ENG.
STRUCTURAL ENGINEER
SNC-LAVALIN INC.



CHRIS SVARA, P. ENG.
ELECTRICAL ENGINEER
HARDESTY & HANOVER



BRIAN HAMILL, P. ENG.
MECHANICAL ENGINEER
HARDESTY & HANOVER

TERRY PARDY, P. ENG.
PROJECT MANAGER
SNC-LAVALIN INC.

<u>SECTION</u>	<u>TITLE</u>	<u>PAGES</u>
<u>DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS</u>		
00 00 00	SPECIFICATION TITLE SHEET	1
00 01 07	PROFESSIONAL SEALS PAGE	1
<u>DIVISION 01 - GENERAL REQUIREMENTS</u>		
01 11 00	SUMMARY OF WORK	10
01 14 00	WORK RESTRICTIONS	4
01 14 10	SCHEDULING AND MANAGEMENT OF WORK	4
01 25 20	MOBILIZATION AND DEMOBILIZATION	1
01 29 00	PAYMENT PROCEDURES	5
01 29 83	PAYMENT PROCEDURES FOR TESTING LABORATORY SERVICES	2
01 31 19	PROJECT MEETINGS	4
01 32 16.07	CONSTRUCTION PROGRESS SCHEDULE: BAR CHART (GANTT)	4
01 33 00	SUBMITTAL PROCEDURES	7
01 35 00.06	SPECIAL PROCEDURES FOR TRAFFIC CONTROL	4
01 35 29.06	HEALTH AND SAFETY REQUIREMENTS	12
01 35 43	ARCHAEOLOGICAL, CULTURAL AND ENVIRONMENTAL PROCEDURES	36
01 35 45	ENVIRONMENTAL PROTECTION: REFUELING VEHICLES	3
01 41 00	REGULATORY REQUIREMENTS	2
01 45 00	QUALITY CONTROL	4
01 51 00	TEMPORARY UTILITIES	4
01 52 00	CONSTRUCTION FACILITIES	6
01 56 00	TEMPORARY BARRIERS AND ENCLOSURES	3
01 61 00	COMMON PRODUCT REQUIREMENTS	6
01 71 00	EXAMINATION AND PREPARATION	3
01 73 00	EXECUTION	2
01 74 11	CLEANING	2
01 74 19	WASTE MANAGEMENT AND DISPOSAL	11
01 77 00	CLOSEOUT PROCEDURES	3
01 78 00	CLOSEOUT SUBMITTALS	9
01 79 00	DEMONSTRATION AND TRAINING	3
01 91 13	GENERAL COMMISSIONING (CX) REQUIREMENTS	10
01 91 31	COMMISSIONING (CX) PLAN	11
01 91 33	COMMISSIONING FORMS	3
01 91 41	COMMISSIONING TRAINING	3
<u>DIVISION 02 - EXISTING CONDITIONS</u>		
02 41 13	SELECTIVE SITE DEMOLITION	15
02 41 13.13	PAVING REMOVAL	6
02 41 16	STRUCTURE DEMOLITION	8
02 42 00	REMOVAL AND SALVAGE OF CONSTRUCTION MATERIAL	2
02 83 10	LEAD-BASED PAINT ABATEMENT: MINIMUM REQUIREMENTS	8
<u>DIVISION 03 - CONCRETE</u>		
03 01 31	CONCRETE CUTTING	2
03 10 00	CONCRETE FORMING AND ACCESSORIES	6
03 20 00	CONCRETE REINFORCING	6
03 30 00	CAST-IN-PLACE CONCRETE	15
03 35 00	CONCRETE FINISHING	4
<u>DIVISION 05 - METALS</u>		
05 12 33	STRUCTURAL STEEL FOR BRIDGES	19

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

06 05 73	WOOD TREATMENT	4
06 15 00	WOOD DECKING	7

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 14 13	HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING	5
07 19 00	WATER REPELLENTS	5
07 92 00	JOINT SEALANTS	8

DIVISION 09 - FINISHES

09 91 13.23	EXTERIOR PAINTING OF STRUCTURAL STEEL	20
-------------	---------------------------------------	----

DIVISION 24 - HYDRAULICS

24 05 00	HYDRAULIC WORKS	26
----------	-----------------	----

DIVISION 26 - ELECTRICAL

26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	10
26 05 20	WIRE AND BOX CONNECTORS (0-1000 V)	2
26 05 21	WIRE AND CABLES (0-1000 V)	3
26 05 22	CONNECTORS AND TERMINATIONS	2
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	2
26 05 31	SPLITTERS, JUNCTION, PULL BOXES AND CABINETS	2
26 05 32	OUTLET BOXES, CONDUIT BOXES AND FITTINGS	3
26 05 34	CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS	4
26 24 16.01	PANELBOARDS: BREAKER TYPE	2
26 24 19	PDP AND MISCELLANEOUS ELECTRICAL WORK	19
26 24 21	OPERATOR CONTROL CONSOLE	3
26 27 16	ELECTRICAL CABINETS AND ENCLOSURES	2
26 56 20	NAVIGATION LIGHTS	2
26 56 21	TRAFFIC GATES	7

DIVISION 29 - MECHANICAL

29 05 00	MECHANICAL WORK - GENERAL	33
----------	---------------------------	----

DIVISION 31 - EARTHWORKS

31 11 00	CLEARING AND GRUBBING	5
31 14 13	SOIL STRIPPING AND STOCKPILING	2
31 22 13	ROUGH GRADING	3
31 23 33.01	EXCAVATING, TRENCHING AND BACKFILLING	8

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 11 16.01	GRANULAR SUB-BASE	2
32 11 23	AGGREGATE BASE COURSES	2
32 12 13.16	ASPHALT TACK COATS	2
32 12 13.23	ASPHALT PRIME COATS	5
32 12 16.01	ASPHALT PAVING: SHORT FORM	5
32 15 60	ROADWAY DUST CONTROL	1
32 16 00	CURBS, GUTTERS AND SIDEWALKS	4
32 17 23	PAVEMENT MARKINGS	3
32 91 19.13	TOPSOIL PLACEMENT AND GRADING	3
32 92 23	SODDING	5

DIVISION 33 - UTILITIES

33 46 16	SUBDRAINAGE PIPING	5
----------	--------------------	---

DIVISION 34 - TRANSPORTATION

34 80 00	HIGHWAY SIGNAGE	3
34 81 00	TRAFFICK SIGNALS	4

APPENDICES

APPENDIX A	PARKS CANADA OCCUPATIONAL HEALTH & SAFETY (OH&S) ATTESTATION FORM
APPENDIX B	GEOTECHNICAL REPORT
APPENDIX C	SITE SPECIFIC BASIC IMPACT ANALYSIS
APPENDIX D	ARCHAEOLOGICAL OVERVIEW ASSESSMENT
APPENDIX E	SITE-SPECIFIC DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS SURVEY REPORT (to be provided by PCA)

LIST OF DRAWINGS

CIVIL:

C01	EXISTING SITE PLAN, REMOVALS AND SIDIMENT CONTROL
C02	SERVICING & GRADING SITE PLAN
C03	NEW WARSAW BRIDGE PLAN AND PROFILE
C04	PAVEMENT MARKINGS AND SIGNAGE
C05	DETAILS

STRUCTURAL:

S01	STRUCTURAL NOTES - SHEET 1
S02	STRUCTURAL NOTES - SHEET 2
S05	GENERAL ARRANGEMENT
S10	SUBSTRUCTURE LAYOUT EXISTING CONDITIONS
S11	SUBSTRUCTURE LAYOUT NEW CONDITIONS
S12	WEST ABUTMENT MODIFICATION EXISTING & NEW PLANS & SECTIONS
S13	WEST ABUTMENT REINFORCING PLANS & SECTIONS
S14	WEST ABUTMENT REINFORCING SECTIONS
S15	EAST ABUTMENT MODIFICATION EXISTING & NEW PLANS & SECTIONS
S16	EAST ABUTMENT REINFORCING PLANS & SECTIONS
S17	EAST ABUTMENT REINFORCING SECTIONS
S18	PIVOT PIER MODIFICATION EXISTING AND NEW PLANS & SECTIONS
S19	ABUTMENT DETAILS
S20	MISCELLANEOUS DETAILS
S30	SUPERSTRUCTURE LAYOUT - EXISTING CONDITIONS
S31	STEEL WORK LAYOUT - NEW CONDITIONS
S32	EXISTING & NEW GRATING PLAN
S33	NEW CONCRETE DECK LAYOUT
S34	R.C. DETAILS
S35	LONGITUDINAL GIRDER - G1 DETAILS
S36	LONGITUDINAL GIRDER - G2 DETAILS
S37	LONGITUDINAL GIRDER - G1/G2 PRECAMBER
S38	LONGITUDINAL GIRDER - G1/G2 DETAILS
S39	PIVOT GIRDER G3 DETAILS - SHEET 1
S40	PIVOT GIRDER G3 DETAILS - SHEET 2
S41	NEW CONCRETE DECK ELEVATIONS
S42	TRANSVERSE BEAM B1 DETAILS - SHEET 1
S43	TRANSVERSE BEAM B1 DETAILS - SHEET 2
S44	TRANSVERSE BEAM B2 DETAILS
S45	TRANSVERSE BEAM B4 DETAILS
S46	TRANSVERSE BEAM B5, B6 & B7 DETAILS
S47	TRANSVERSE BEAM B8 DETAILS - SHEET 1
S48	TRANSVERSE BEAM B8 DETAILS - SHEET 2
S49	BRACING PLAN, SECTIONS & DETAILS
S50	STEEL PARAPET SUPPORT BEAM PLAN, SECTIONS AND DETAILS
S51	SIDEWALK SUPPORT BEAM PLAN, SECTIONS AND DETAILS

S52	TRAFFIC BARRIER PLAN, SECTIONS, AND DETAILS
S53	HANDRAIL PLAN, SECTIONS, AND DETAILS
S54	TIMBER WALKWAY DETAILS

MECHANICAL:

M01	MECHANICAL/HYDRAULIC SCOPE OF WORK
M02	MECHANICAL WORK LAYOUT
M03	PIVOT BEARING ASSEMBLY
M04	SPAN DRIVE CYLINDER ASSEMBLY
M05	LIVE LOAD BEARING ASSEMBLY
M06	BALANCE WHEELS AND TRACK ASSEMBLY
M07	BALANCE WHEEL BOLSTERS
M08	END CASTOR ASSEMBLY
M09	END LIFT ASSEMBLY
M10	SPAN LOCK ASSEMBLY
M11	END STOP ASSEMBLY
M12	HYDRAULIC SCHEMATIC AND NOTES
M13	HYDRAULIC SYSTEM AND TROUGH DETAILS
M14	MISCELLANEOUS DETAILS

ELECTRICAL:

E01	SCOPE OF WORK, ABBREVIATIONS, AND SYMBOLS
E02	POWER DISTRIBUTION SCHEMATIC
E03	CONTROL POWER AND TRAFFIC SCHEMATIC
E04	SPAN CONTROL SCHEMATIC ONE
E05	SPAN CONTROL SCHEMATIC TWO
E06	CONTROL CONSOLE
E07	CONTROL CONSOLE LAYOUT
E08	RELAY PANEL
E09	CONDUIT BLOCK DIAGRAM
E10	ELECTRICAL PLAN
E11	TRAFFIC AND PEDESTRIAN GATES
E12	NAVIGATION LIGHTS
E13	MOTOR CONTROL CENTER
E14	UTILITY LAYOUT
E15	ELECTRICAL ROOM

END OF SECTION

PART 1 - GENERAL

- 1.1 PRECEDENCE .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Specification.
- 1.2 REFERENCES .1 Canada National Parks Act;
.2 Canadian Environmental Protection Act;
.3 Ontario Environmental Protection Act;
.4 Ontario Public Transportation and Highway Improvement Act.
- 1.3 WORK COVERED BY CONTRACT DOCUMENTS .1 Work under this Contract comprises the furnishing of all labour, materials and equipment required to provide construction services for the replacement of the Warsaw Road Swing Bridge located on Parkhill Road East along the Trent-Severn Waterway (Parks Canada) in Peterborough, Ontario. This project includes but is not limited to:
.1 Concrete abutment and pivot pier rehabilitation;
.2 Demolition of existing steel superstructure;
.3 Fabrication and Installation of new steel superstructure; and
.4 Replacement of existing mechanical and electrical systems.
- 1.4 CONTRACT METHOD .1 Construction work under a combined price contract.
.2 Relations and responsibilities between Contractor and subcontractors and suppliers assigned by Owner are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:
.1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder when Contractor is required to furnish such bonds to Departmental Representative.
.2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.
- 1.5 COST BREAKDOWN .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract price.
.1 Submit prices for each line item for the unit of measure specified.
.2 Within 48 hours of acceptance of bid submit a list
-

of subcontractors.

- 1.6 FUTURE WORK .1 Ensure that Work avoids encroachment into areas identified for future work.
- 1.7 CODES .1 Meet or exceed requirements of: Contract document, specified standards, codes and referenced documents.
- .2 Conform to the latest revision of any referenced standard as re-affirmed or revised to the date of specification. Standards or codes not dated shall be deemed editions in force on the date of tender advertisement.
- .3 Amendments to any referenced standards up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- 1.8 DOCUMENTS REQUIRED .1 Maintain at job site, one copy of each of the following:
- .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 List of outstanding shop drawings.
 - .6 Change orders.
 - .7 Other modifications to contract.
 - .8 Field test reports.
 - .9 Copy of approved work schedule.
 - .10 Health and Safety Plan and other safety related documentation.
 - .11 Manufacturer's installation and application instructions.
 - .12 All testing results.
 - .13 Parks Canada Occupational Health & Safety (OH&S) Attestation Form.
 - .14 Other documentation as specified.
- 1.9 WORK SCHEDULE .1 Provide within 5 working days after Contract Award, construction schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents and as specified herein.
- .2 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of the Departmental Representative.
- .3 Work schedule, completion date and operational requirements shall comply with requirements in Section 01 14 10 - Scheduling and Management of

Work.

- .4 Contractor to maintain work zone free of standing water by dewatering as required throughout the entire construction period.
 - .5 Maintain fire access/control to areas surrounding the Work area.
- 1.10 CONTRACTOR'S USE OF PREMISES
- .1 Contractor shall coordinate use of site under direction of Departmental Representative. Any additional areas required shall be approved by the Departmental Representative prior to use. Protect and maintain construction laydown area.
 - .2 Obtain and pay for use of additional storage or work areas as required for operations under this Contract.
 - .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
 - .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
 - .5 Contractor must maintain unobstructed road and pedestrian access to the lockmaster house to the immediate North-West of the site on Parks Canada Property.
 - .6 Contractor must maintain access to PCA access roads located south of the bridge, unless indicated otherwise in the contract documentation.
 - .7 Work area as indicated in the contract documents. Coordination / approval from Parks Canada, Corporation of the City of Peterborough and the Province of Ontario to be undertaken prior to construction initiation.
 - .8 Maintain the site in a tidy condition free from the accumulation of waste products and debris during construction. Undertake continuous maintenance each day. Maintain roadway and structures in a safe and tidy condition. Upon Substantial Completion of the work, remove surplus products, tools, machinery and equipment from the site. Completion of clean-up is required for total performance of the work.
 - .9 Provide any and all traffic control and detour services required for the project.
-

- .10 Main vehicular access routes and staging areas to be restricted to present-day roadways, parking lots and pathways.
 - .11 Obtain all necessary permits to perform work and to comply with all permit requirements and conditions.
 - .12 Maintain work during construction. Undertake continuous maintenance each day. Maintain roadway and structures in a safe and tidy condition.
 - .13 At completion of operations condition of existing work: equal or better than that which existed before new work started.
 - 1.11 PARTIAL OWNER OCCUPANY
 - .1 Owner will give notice prior to visiting the site. Upon receipt of notice, allow Owner personnel to gain access to the site.
 - 1.12 PROJECT MEETINGS
 - .1 General Contractor will arrange project meetings and assume responsibility for setting times and recording and distributing meeting minutes.
 - .2 General Contractor shall make available, with adequate notice, meeting facilities for regular project meetings.
 - .3 Attend project meetings as specified. Arrange for and ensure applicable project sub-trades attend meetings as required.
 - 1.13 SETTING OUT OF WORK
 - .1 Set out Work in accordance with Section 01 71 00 - Examination and Preparation.
 - .2 Employ a certified surveyor to mark out work. All surface modifications are restricted to the identified construction limits.
 - .3 Assume full responsibility for and execute complete layout of work site to: locations, lines and elevations indicated.
 - .4 Provide devices needed to layout and construct work.
 - .5 Supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
 - .6 Provide coordinates, elevations and dimensions from site as required by the Departmental
-

Representative.

1.14 EXISTING
SERVICES

- .1 Notify utility service provider of intended interruption of services and obtain required permission.
- .2 Work that involves temporary disruption of services will be scheduled through the General Contractor. Give Departmental Representative minimum 72 hours notice of any disruption of services.
- .3 Before commencing work, establish location and extent of service lines in area of Work and notify service provider of findings.
- .4 Submit schedule to and obtain approval from service for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide alternative routes for pedestrian and vehicular traffic.
- .6 Establish location and extent of service lines in area of work before starting Work. Service provider of findings.
- .7 Submit schedule to and obtain approval from service provider for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .8 Provide temporary services when directed by service provider to maintain critical systems.
- .9 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .10 Where unknown services are encountered, immediately advise service provider and confirm findings in writing.
- .11 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .12 Record locations of maintained, re-routed and abandoned service lines.
- .13 Confirm all inverts and critical elevations in the field prior to construction.

- .14 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- 1.15 ADDITIONAL DRAWINGS/INSTRUCTIONS .1 Departmental Representative may furnish additional drawings and/or site instructions for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in the Contract Documents.
- 1.16 CONSTRUCTION SAFETY MEASURES .1 The Contractor must submit a Safety Plan prior to the pre-construction meeting.
- .2 The Contractor must sign and submit a Parks Canada Occupational Health and Safety (OH&S) Attestation Form, see Appendix A for form.
- 1.17 EXCAVATION .1 Prior to commencing any excavation, check for and become aware of all buried utilities and submit findings for review and approval by Departmental Representative.
- .2 Contractor to make every effort to minimize extents of excavation within area of work. Restrict excavations to limits indicated on drawings. Notify Departmental Representative of any areas where additional excavations are required.
- .3 In the event that items of archaeological or cultural interest arise, excavation shall cease in the immediate area and Parks Canada Department Representatives shall be informed immediately.
- 1.18 STANDARD HOURS .1 Carry out noise generating Work in accordance with 01 14 00 - Work Restrictions.
- .2 Work that involves temporary disruption of services will be scheduled by the General Contractor through the appropriate service provider and notify the Department Representative.
- 1.19 SITE CONDITIONS .1 Promptly notify Departmental Representative if subsurface conditions differ materially from those indicated in Contract Documents or a reasonable assumption of probable conditions based thereon.
- .2 Contractor shall visit the Warsaw Road Swing Bridge and review existing site conditions prior to starting the work. Site visits and timeline to be confirmed by Parks Canada.
- .3 A geotechnical investigation has been completed. For subsurface information refer to Appendix B for Geotechnical Report.
-

- 1.20 EXISTING SURVEY .1 Pre and post construction topographic field survey to confirm existing elevations and for layout of the structural work items and for collection of as-built condition information. Including features adjacent to the area of work.
- 1.21 WORK WITHIN HISTORIC SITE BOUNDARIES .1 The Work is within a National Park. It is essential that all lands remain as undisturbed as possible. Use standards and methods beyond those for normal construction in order to protect the environment and ensure aesthetics of the Work. Strictly adhere to contract limits and take every precaution to minimize environmental damage and disruption to vegetation, wildlife habitat, and structures or existing services, both on construction and storage sites.
- .1 If damage occurs during construction, bear the expense to immediately restore such damaged areas to the satisfaction of the Departmental Representative.
 - .2 If restoration fails to satisfy specified requirements, the Departmental Representative may complete repairs at the Contractor's expense.
 - .3 Ensure no damage will be done to aerial or underground electrical/communications cables.
 - .4 Submit all sources of aggregate and asphalt cement to Departmental Representative at least two weeks prior to start of the Work.
 - .5 Follow Provincial requirements regarding: Pit and Quarry guidelines; and Environmental Construction Practice Specifications.
 - .6 All work at the Warsaw Road Swing Bridge must comply with the Standard and Guidelines for the Conservation of Historic Places in Canada.
 - .7 Vehicular access routes and staging areas will be restricted to present-day roadways and parking lots. If this is not possible, the use of the protective covering such as geotextile protective mats with a wood chip lift or granular "A" gravel is required. Corridors for machinery access within the site will be determined in consultation with Parks Canada's archaeologist, depending on equipment and construction requirements. All protective measures employed must be removed following construction and the area restored to a pre-construction state. Excavation is not permitted during installation or removal of protective covering.
 - .8 No blasting will be permitted at site.
- 1.22 NOISE .1 Fit all construction equipment with standard noise suppression devices. Maintain devices in accordance

- with manufacturer's requirements. Use smaller, less-disturbing equipment where possible.
- .2 Apply the most stringent of PART 1, SUBSECTION 1.19 - STANDARD HOURS or the Corporation of the City of Peterborough's Noise By-Law Chapter 691 amended by 12-016.
- 1.23 AIR QUALITY
- .1 Implement an anti-idling policy for trucks and machinery. In accordance with the Corporation of the City of Peterborough's By-Law No. 08-077.
- .2 Submit dust control measures as part of Environmental Management Plan (EMP) to Parks Canada's Environmental Authority (EA) for review prior to starting Work. Apply dust control measures during periods of dust generation.
- 1.24 RECORD DRAWINGS
- .1 Maintain project record drawings and record accurately deviations from Contract Documents. Record changes in red and mark one (1) set of prints during work. At completion of project and prior to final inspection, neatly transfer markings to second print set and submit both sets to Departmental Representative. Include relevant references to formal change notifications, site instructions or requests for information as applicable.
- 1.25 RELICS, ANTIQUES AND WILDLIFE HABITAT
- .1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2 Give immediate notice to Departmental Representative and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.
- 1.26 NATIONAL PARKS ACT
- .1 For projects within boundaries of National Park, perform work in accordance with Parks Canada's Cultural Resource Management Policy and the Standards and Guidelines for the Conservation of Historic Places in Canada.
- 1.27 PERMITS / AUTHORITIES
- .1 Obtain and pay for permits from authorities as required for the Work. Comply with pertinent regulations of authorities having jurisdiction over
-

the Work. Provide copies of permits to Departmental Representative prior to starting the Work.

- .2 Permit requirements include but are not limited to:
 - .1 Parks Canada Historical Regulations Permit
 - .2 Required submission and acceptance of Environmental Management Plan (EMP).

1.28 PRE-ORDERED PRODUCTS

- .1 Contractor responsibility for purchase, handling, and installation of pre-ordered products is same as for other Contractor-furnished products.

1.29 PRE-PURCHASED EQUIPMENT

- .1 Purpose for pre-purchasing this equipment is to ensure delivery to site within required project completion schedule. Obtain necessary shop drawings and proceed to co-ordinate details for installation, expedite, receive, unload, install, connect and test specified equipment, and be responsible for warrantee.
- .2 Equipment specifications for pre-purchased items are included at end of project specification, printed on blue paper for confirmation only.
- .3 Notify Departmental Representative in writing at least 60 calendar days in advance of date on which materials and equipment are required.
 - .1 Pick up materials and equipment no later than 30 calendar days after such date.
- .4 Receive equipment F.O.B. and store and process equipment until installation.

1.30 OWNER FURNISHED ITEMS

- .1 Owner Responsibilities:
 - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
 - .2 Deliver supplier's bill of materials to Contractor.
 - .3 Arrange and pay for delivery to site in accordance with Progress Schedule.
 - .4 Inspect deliveries jointly with Contractor.
 - .5 Submit claims for transportation damage.
 - .6 Arrange for replacement of damaged, defective or missing items.
 - .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .2 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of observed

- discrepancies or problems anticipated due to non-conformance with Contract Documents.
- .3 Receive and unload products at site.
 - .4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
 - .5 Handle products at site, including uncrating and storage.
 - .6 Protect products from damage, and from exposure to elements.
 - .7 Assemble, install, connect, adjust, and finish products.
 - .8 Provide installation inspections required by public authorities.
 - .9 Repair or replace items damaged by Contractor or subcontractor on site (under their control).

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 ACCESS AND EGRESS
- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including excavation areas, stairs, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.
- .1 For design of any temporary structures, submit design and supporting data at least 2 weeks prior to beginning work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- 1.2 USE OF SITE AND FACILITIES
- .1 Execute work with least possible interference or disturbance to normal use of site. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Lay down area to be facilitated and approved by Departmental Representative.
- .3 Maintain existing services and provide for personnel and vehicle access.
- .4 Where security is reduced by work, provide temporary means to maintain security.
- .5 Closures: protect work temporarily until permanent enclosures are completed.
- 1.3 EXISTING SERVICES
- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours, preferably on weekends.
- .3 Provide for personnel, pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- 1.4 SPECIAL REQUIREMENTS
- .1 All work at the Warsaw Road Swing Bridge shall be coordinated with and approved by Parks Canada prior to construction.
-

- .2 Carry out noise generating Work during the following time periods:
 - .1 Monday to Saturday: 07:00 to 18:00.
 - .2 Sunday: 12:00 to 18:00.
 - .3 No construction activities to occur in zones identified and delineated by Parks Canada's archaeologist as No-Go Zones without prior Departmental Representative's written approval and ground protection measures in place. All construction activities will be restricted to present-day roadways, pathways and parking lots.
 - .4 Vehicular access routes and staging areas will be restricted to present-day roadways and parking lots. If this is not possible, the use of protective covering such as geotextile protective mats with wood chip lift or granular "A" gravel is required. Corridors for machinery access within the site will be determined in consultation with Departmental Representative, depending on the equipment construction requirements. Submit vehicular access route, staging areas and corridors for access as a part of the Environmental Management Plan (EMP) to Parks Canada's Environmental Authority for review. All protective measures employed must be removed following construction and the restored to a pre-construction state. Excavation is not permitted during installation or removal of protective covering.
 - .5 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule: Bar Chart (GANTT).
 - .6 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
 - .7 Keep within limits of work and avenues of ingress and egress.
 - .8 Contractor must ensure that canal/locks are not made inaccessible, unusable, and non-functional to boat traffic due to project works during 2019 and 2020 navigation season. 2019 navigation season occurs from May 17, 2019 to October 14, 2019, 2020 navigation seas dates between May 2020 to October 2020 to be confirmed by PCA.
 - .9 Prior to the use of cranes or any other machinery on site, confirm swing areas and any potential interference from overhead wires. Contractor responsible for identifying any possible
-

operational interference issues with proposed equipment.

- .10 Contractor must ensure that construction loads do not exceed standard highway loading or any load restrictions on the structure.
- .11 Parks Canada has identified that the power control line for the adjacent canal/lock assemblies are buried within the work area. Any excavation works are to be conducted with due care to avoid severing these lines. In the event a line is severed, Contractor must repair the line.
- .12 The Contractor must provide Parks Canada with access to site one week prior to start of 2020 navigation season for maintenance purposes.
- .13 Deliver materials outside of peak traffic hours 07:00 to 09:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

1.5 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security Clearance:
 - .1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require to enter premises.
 - .2 Obtain requisite clearance, as instructed, for each individual required to enter premises.
 - .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
 - .4 Contractor's personnel will require satisfactory RCMP initiated security screening in order to complete Work in premises and on site.

1.6 SMOKING ENVIRONMENT

- .1 Comply with provincial or municipal smoking by-laws, whichever is more restrictive.

1.7 WATERWAY RESTRICTIONS

- .1 Work may not interfere with the 2019 and 2020 regular waterway operation or Trent-Severn Waterway Spring Maintenance operations.
- .2 2019/2020 Spring Season Waterway Operating Hours (May 17, 2019 to June 23, 2019, 2020 dates and hours to be confirmed by PCA):
 - .1 10:00-15:30 - Monday to Thursday.

- .2 09:00-18:30 - Friday to Sunday; and Victoria Day.
- .3 2019/2020 Summer Season Waterway Operating Hours (June 24, 2019 to September 2, 2019, 2020 dates and hours to be confirmed by PCA):
 - .1 09:00-17:30 - Monday to Thursday.
 - .2 09:00-18:30 - Friday to Sunday; Canada Day, August Civic Holiday and Labour Day.
- .4 2019/2020 Fall Season Waterway Operating Hours (September 3, 2019 to October 14, 2019, 2020 dates and hours to be confirmed by PCA):
 - .1 10:00-15:30 - Monday to Friday.
 - .2 09:00-16:30 - Saturday and Sunday; and Thanksgiving.
- .5 Canal is naturally dewatered in the Fall (date to be confirmed by PCA)). Any further dewatering required to complete the work is only with approval of the Departmental Representative and is contactor responsibility.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

- bird breeding window from April 1st to August 31st in any year. This also applies to the bridge structure and buildings with presence of Barn Swallow. Mitigation could include exclusion netting placed prior to nesting season.
- .7 All work shall be avoided in areas of turtle habitat during the turtle nesting season from May 15th to August 15th in any year.
- .3 Schedule to indicate all calendar dates from commencement to completion of all work within the time stated in the accepted bid.
- .4 Provide sufficient detail in schedule to clearly illustrate entire implementation plan, depicting efficient coordination of tasks and resources, to achieve completion of work on time and permit effective monitoring of work progress in relation to established milestones.
- .5 Work schedule content to include as a minimum the following:
- .1 Bar Charts (GANTT), indicating all work activities, tasks and other project elements, their anticipated durations, planned dates for achieving key activities and major project milestones supported with;
- .2 Written narrative on key elements of work illustrated in bar chart, providing sufficient details to demonstrate a reasonable implementation plan for completion of project within designated time.
- .3 Generally, Bar Charts derived from commercially available computerized project management systems are preferred but not mandatory.
- .6 Work schedule must take into consideration and reflect any work phasing.
- .7 Schedule work in cooperation with the Departmental Representative.
- .8 Completed schedule shall be approved by Departmental Representative. When approved, take necessary measures to complete work within scheduled time. Do not change schedule without Departmental Representative's approval.
- .9 Ensure that all subtrades and subcontractors are made aware of the work restraints and operational restrictions specified.
- .10 Schedule Updates:
-

- .1 Submit when requested by Departmental Representative.
- .2 Provide information and pertinent details explaining reasons for necessary changes to implementation plan.
- .3 Identify problem areas, anticipated delays, impact on schedule and proposed corrective measures to be taken.
- .11 Departmental Representative will make interim reviews and evaluate progress of work based on approved schedule. Frequency of such reviews will be as decided by Departmental Representative. Address and take corrective measures on items identified by reviews and as directed by Departmental Representative. Update schedule accordingly.
- .12 In every instance, change or deviation from the Work Schedule, no matter how minimal the risk or impact on safety or inconvenience to users or public might appear, will be subject to prior review and approval by the Departmental Representative.

1.4 ERECTION PLANS

- .1 Submit erection plan for new swing bridge. Erection plan shall include, but shall not be limited to the following information:
 - .1 Health and Safety Program for bridge construction and replacement;
 - .2 List any in-canal works required throughout schedule of work;
 - .3 Indicate erection equipment, including crane and jacking equipment where required. Include anticipated hoisting arrangements and procedure and associated outrigger loads;
 - .4 Include drawings for any temporary support structures, stamped by a Professional Engineer registered in the Province of Ontario;
 - .5 Submit planned roadway closures in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.
- .2 Submit demolition plan for existing swing bridge. Demolition plan shall include, but shall not be limited to the following information:
 - .1 Health and Safety Program for bridge demolition along with the erection Health and Safety Program;
 - .2 List any in-canal works required throughout schedule of work;
 - .3 Include debris removal plan in alignment with Section 02 41 16 - Structure Demolition and Section 01 74 19 - Waste Management and Disposal;
 - .4 Include drawings for any temporary support structures, stamped by a Professional Engineer registered in the Province of Ontario;
 - .5 Indicate demolition equipment, including

- anticipated hoisting/lowering arrangements and procedure and associated outrigger loads;
- .6 Submit planned roadway closures in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION .1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, offices, supplies and incidentals to and from the project sites.
- .2 For the purposes of mobilization and demobilization, "project site" means the bridge site location.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL
REQUIREMENTS

- .1 The Form of Tender includes several lump sum priced items and several unit priced items.
- .2 The total tendered price shall be the sum of the lump sum items plus the amounts calculated from the unit priced items based on the approximate quantities identified for each of the unit priced items.
- .3 The Contractor in submitting their Tender for the project understand that they will only be entitled to payment under the unit priced items when prior written authorization has been received from the Departmental Representative for utilization and then only to the extent of the work authorized by the Departmental Representative.
- .4 The estimated quantities shown in the Unit Price Table are provided for the purpose of comparing proposals and are not guaranteed to be final, accurate or complete. Actual quantities may vary from those initially estimated and will not be grounds for renegotiations of proposal unit prices. The unit prices shall be applicable to greater or lesser quantities. Payment shall be at the unit prices in the proposal.
- .5 Unit priced items are included in this Contract for possible work which may or may not be required to complete the project, for which an accurate assessment of the quantity of the item cannot be made until the work is in progress.
- .6 Additional instructions for measurement and/or payment for items of the work may be contained in specific sections of the Technical Specifications. In the case of a conflict between the instructions for measurement and payment contained in this section with that of any other section, the requirement of this section shall apply.
- .7 The submitted tender prices will be inclusive of all costs for the complete supply and installation of all materials, labour and equipment required to complete the work. No separate payment will be made for any testing, inspections and approvals required by Contractor.
- .8 Payment shall be calculated as follows:
 - .1 The quantity for each pay item on which actual work has been performed shall be measured.

- .2 For the lump sum items, multiply the percent completed by the value of the lump sum items.
 - .3 For each Unit Price item, this quantity shall be multiplied by the applicable Unit Price as provided in the Tender Form.
 - .9 All measurement shall be along a horizontal plane unless otherwise indicated.
 - .10 Lengths refer to measurements along centreline of installation unless otherwise indicated.
 - .11 Materials specified for measurement by mass shall be weighed on scales approved by Departmental Representative. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.
- 1.2 APPLICATIONS FOR PROGRESS PAYMENT
- .1 Make applications for payment on account as provided in Agreement as Work progresses.
 - .2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
 - .3 Submit to Departmental Representative, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.
- 1.3 SCHEDULE OF VALUES
- .1 Provide schedule of values supported by evidence to Departmental Representative to be used as basis for applications for payment.
 - .2 Include statement based on schedule of values with each application for payment.
 - .3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence to Departmental Representative to establish value and delivery of products.
- 1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS
- .1 Submit separate schedule of unit price items of Work requested in Tender form.
 - .2 Make format of progress claim match Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
 - .1 Cost of material.
 - .2 Delivery and unloading at site.
 - .3 Sales taxes.
-

.4 Installation, overhead and profit.

1.5 PROGRESS PAYMENT .1 Departmental Representative will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Departmental Representative determines to be due. If Departmental Representative amends application, Departmental Representative will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK .1 Prepare and submit to Departmental Representative comprehensive list of items to be completed or corrected and apply for a review by Departmental Representative to establish Substantial Performance of Work. Failure to include items on list does not alter responsibility to complete Contract.

.2 No later than 10 days after receipt of list and application, Departmental Representative will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.3 Departmental Representative shall state date of Substantial Performance of Work or designated portion of Work in certificate.

.4 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Departmental Representative, establish date for completion of Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK .1 After issuance of certificate of Substantial Performance of Work:
.1 Submit application for payment of holdback amount.
.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.2 After receipt of application for payment and sworn statement, Departmental Representative will issue certificate for payment of holdback amount.

.3 Where holdback amount has not been placed in a separate holdback account, Owner shall, 10 days prior to expiry of holdback period stipulated in

lien legislation applicable to Place of Work,
place
holdback amount in bank account in joint names of
Owner and Contractor.

.4 Amount authorized by certificate for payment of
holdback amount is due and payable on day
following expiration of holdback period
stipulated in lien legislation applicable to
Place of Work. Where lien legislation does not
exist or apply, holdback amount is due and
payable in accordance with other legislation,
industry practice, or provisions which may be
agreed to between parties. Owner may retain out
of holdback amount sums required by law to
satisfy liens against Work or, if permitted by
lien legislation applicable to Place of Work,
other third party monetary claims against
Contractor which are enforceable against Owner.

1.8 PROGRESSIVE
RELEASE OF HOLDBACK

.1 Where legislation permits, if Departmental
Representative has certified that Work of
subcontractor or supplier has been performed
prior to Substantial Performance of Work, Owner
shall pay holdback amount retained for such
subcontract Work, or products supplied by such
supplier, on day following expiration of holdback
period for such Work stipulated in lien
legislation applicable to Place of Work.

.2 In addition to provisions of preceding paragraph,
and certificate wording, ensure that such
subcontract Work or products is protected pending
issuance of final certificate for payment and be
responsible for correction of defects or Work not
performed regardless of whether or not such was
apparent when such certificates were issued.

1.9 FINAL PAYMENT

.1 Submit application for final payment when Work is
completed.

.2 Departmental Representative will, no later than
10 days after receipt of application for final
payment, review Work to verify validity of
application. Departmental Representative will
give notification that application is valid or
give reasons why it is not valid, no later than 7
days after reviewing Work.

.3 Departmental Representative will issue final
certificate for payment when application for
final payment is found valid.

1.10 LUMP SUM ITEM

.1 No separate measurement for payment shall be made
for any work completed under this item.

- .2 Lump Sum items are to be itemized by Section for payment measurements.
 - .3 Any and all items not specifically included in the unit price items are considered incidental to the work and are to be included in the lump sum portion of the work. The work of the lump sum item shall be considered to include, all works and materials which are required for completion of the project, exclusive of those covered by the unit price items. This includes but is not limited to the following sections, the individual specification Sections, and the Contract Documents.
 - .4 All work and material required under the Division 01 through 34 sections and relevant Contract Documents shall be included in the lump sum price and separately itemized by Division as indicated in the tender form.
- 1.11 UNIT PRICE ITEMS
- .1 Unit prices are full compensation for the work necessary to complete each item in the Contract and in combination for all work necessary to complete the Work as a whole.
 - .2 Selective Site Demolition: Concrete Repairs
Unit of Measurement: square meter (m²)
Estimated Quantity: 40 m²
Method of Measurement: Area of repair on existing abutments and pier.
This item includes: furnishing of all materials, aggregates, cement, supplementary cementing materials, concrete mixes, admixtures, tools, equipment, falsework, forms, bracing, labour, placing, compacting, finishing, curing, surface finishing, and all other items required to complete this work.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections including but not limited to:
- .1 Section 03 30 00 - Cast-in-Place Concrete
 - .2 Section 05 12 33 - Structural Steel for Bridges
 - .3 Section 32 12 16.01 - Asphalt Paving: Short Form
- 1.2 APPOINTMENT AND PAYMENT .1 Departmental Representative will appoint and pay for services of testing laboratory except as follows:
- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
 - .6 Additional tests specified in the following paragraph.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- 1.3 CONTRACTOR'S RESPONSIBILITIES .1 Provide labour, equipment and facilities to:
- .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .3 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.
-

- .4 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 Ministry of Transportation, Ontario (MTO):
.1 Ontario Traffic Manual for Work on Roadways - 1999.
- 1.2 ADMINISTRATIVE .1 Contractor shall schedule and administer project meetings throughout the progress of the work.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative, meeting participants and affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- 1.3 PRECONSTRUCTION MEETING .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
.1 Appointment of official representative of participants in the Work.
.2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedule: Bar Chart (GANTT).
.3 Health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
.4 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal
-

- Procedures.
- .5 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 Owner provided products.
 - .8 Record drawings and specifications in accordance with Sections 01 33 00 - Submittal Procedures and Section 01 78 00 - Closeout Submittals.
 - .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .11 Monthly progress claims, administrative procedures, photographs, hold backs, progress schedule.
 - .12 Appointment of inspection and testing agencies or firms.
 - .13 Insurances, transcript of policies.
 - .14 Review of Value Management Proposals clause, submissions of proposals, compensation, and objectives.
 - .15 Review of Parks Canada property limits and access to Parks Canada facilities.
 - .16 Requirements for traffic control and vehicular detour in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.
 - .17 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .18 Delivery schedule of specified equipment in accordance with Section 01 32 16.07 - Construction Progress Schedule: Bar Chart (GANTT).
- 1.4 PRE-INSTALLATION MEETING .1 Convene pre-installation meeting four weeks prior to beginning on-site delivery/on-site installation, with Departmental Representative, General Contractor, Site Superintendent, Steel Fabricator and Steel Erector to:
- .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
- 1.5 PROGRESS MEETINGS .1 During course of Work and two weeks prior to project completion, schedule progress meetings weekly.
- .2 Contractor, major Subcontractors and key personnel involved in Work and Departmental Representative
-

are to be in attendance.

- .3 Notify parties minimum four days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance for review and approval within two days after meeting.
- .5 Agenda to include the following:
 - .1 Review of Work progress since previous meeting.
 - .2 Field observations, problems, conflicts.
 - .3 Problems which impede construction schedule.
 - .4 Review of off-site fabrication delivery schedules.
 - .5 Corrective measures and procedures to regain projected schedule. Revision to construction schedule.
 - .6 Revision to construction schedule.
 - .7 Progress schedule, during succeeding work period.
 - .8 Review submittal schedules: expedite as required.
 - .9 Maintenance of quality standards.
 - .10 Review proposed changes for effect on construction schedule and on completion date.
 - .11 Review of health and safety issues or concerns.
 - .12 Other business.

1.6 INFORMATIONAL AND
WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Ontario Traffic Manual, Book 7: Temporary Conditions.
- .3 Place signs and other devices in locations recommended in Ontario Traffic Manual, Book 7: Temporary Conditions.
- .4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
- .5 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, an expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): A graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: Original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five-day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: Number of work periods (not including holidays or other nonworking periods) required to complete an activity or other Project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: A summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: A significant event in Project, usually completion of major deliverable.
- .8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: Overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
 - .2 Plan to complete Work in accordance with prescribed milestones and time frame.
-

- .3 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.
- .4 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.
- .4 Submit Mechanical and Electrical Shop Drawings within 20 working days of award of contract.
- .5 Submit Structural Shop Drawings within 20 working days of award of contract.

1.4 PROJECT MILESTONES

- .1 Project milestones form targets for Project Schedule.
 - .1 Period to reach Substantial Completion to match work schedule provided. Refer to Section 01 11 00 - Summary of Work.
 - .2 Ensure city noise by-laws are respected in reaching project milestones.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
 - .2 Ensure detailed Project Schedule respects submittal requirements and key project dates, identifies project milestones and includes as minimum activity types as follows and in the work sequence in Section 01 11 00 - Summary of Work:
-

- .1 Mobilization to site.
- .2 Fabrication of Bridge Steel Superstructure.
- .3 Fabrication of Electrical and Mechanical components.
- .4 Assembling Bridge Steel Superstructure off-site to test balance and camber.
- .5 Decommission/disconnect/make safe existing mechanical and electrical components.
- .6 Contractor to determine and have approved appropriate detour route and install all required traffic control signage.
- .7 Undertake concrete rehabilitation of bearing seats on east and west abutments.
- .8 Remove existing center pivot bearing and locking pin.
- .9 Remove existing bridge superstructure including girders, deck and floor frames.
- .10 Remove and repair deteriorated and delaminated concrete from abutments and pivot pier as per contract documents.
- .11 Installation of balance wheel and track assembly.
- .12 Installation of new bridge superstructure.
- .13 Installation of new hydraulic system, span drive and end lifts.
- .14 Installation of new electrical system, traffic lights and gates.
- .15 Reinstating site to previous conditions.
- .16 Commissioning the bridge.
- .17 Demobilization from site.

- .3 Contractor to host meeting to discuss proposed plan for bridge replacement.

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule every 2 weeks reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 ADMINISTRATIVE
- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Do not proceed with Work affected by submittal until review is complete.
 - .3 Present shop drawings, product data, and samples in SI Metric units.
 - .4 Where items or information is not produced in SI Metric units converted values are acceptable.
 - .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
 - .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
 - .7 Verify field measurements and affected adjacent Work are coordinated.
 - .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
 - .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
 - .10 Keep one reviewed copy of each submission on site.
 - .11 Make any changes in submissions which Departmental Representative may require consistent with Contract Documents and resubmit as directed by Departmental Representative.
-

- .12 Notify Departmental Representative, in writing, when resubmitting of any revisions other than those requested by Departmental Representative.

1.2 SHOP DRAWINGS AND
PRODUCT DATA

- .1 Submit shop drawings, product data, and all other required documentation in accordance with this Section.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada verifying that the details and procedures are consistent with the Contract Documents.
- .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .5 Allow 10 working days for Departmental Representative's review of each submission.
- .6 Allow up to 15 working days for complex submissions. These include but are not limited to: bridge superstructure steel shop drawings, concrete reinforcing shop drawings.
- .7 The contractor shall schedule 4 weeks (20 business days) for the detailed single review of the bridge shop drawings. This review time will start the following business day after the contractor has submitted the shop drawings to the Departmental Representative.

Fabrication shall not commence prior to the review of shop drawings by the Departmental Representative. Any fabrication done without the reviewed shop drawings may be rejected.

If additional reviews of shop drawings are required, then additional time beyond that scheduled for the initial review will be required and the time required for subsequent shop drawing

reviews shall not be constituted in any way by the Contractor as a delay.

- .8 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .9 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
 - .10 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .11 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
 - .12 After Departmental Representative's review, distribute copies.
 - .13 Submit 1 PDF digital file of shop drawings for each requirement requested in specification
-

Sections and as Departmental Representative may reasonably request.

- .14 Submit 1 PDF digital file of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .15 Submit 1 PDF digital file of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
 - .16 Submit 1 PDF digital file of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .17 Submit 1 PDF digital file of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .18 Submit 1 PDF digital file of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .19 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .20 Submit 1 PDF digital file of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
-

- .21 Delete information not applicable to project.
- .22 Supplement standard information to provide details applicable to project.
- .23 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .24 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Samples: examples of materials, equipment quality, finishes, workmanship.
- .2 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .3 Deliver samples prepaid to Departmental Representative's business address.
- .4 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- .8 Where colour, pattern or texture is criterion, submit full range of samples.

1.4 PROGRESS
DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, 2 to 3-megapixel resolution monthly with progress statement and as directed by Departmental Representative. Photos to have time/date stamps.
- .2 Photograph Identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
 - .1 Location of viewpoints determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly as directed by Departmental Representative.
 - .1 Upon completion of: framing and services before concealment of Work and as directed by Departmental Representative.

1.5 CERTIFICATES AND
TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Safety and Insurance Board Experience Report.
- .2 Submit transcription of insurance immediately after award of Contract.
- .3 Steel fabricator(s) welders' certificates. Only welders who have submitted their certificates, and only for weld types and positions appearing on individual's certificate, are permitted to perform welding work on this project.

1.6 WORK SCHEDULE

- .1 Provide within 5 working days after contract award, schedule showing anticipated progress stages and final completion of work within time period required by Contract Documents.
- .2 Work schedule shall be updated every two weeks to reflect progress.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated

by Contractor in conjunction with and to approval
of Departmental Representative.

- 1.7 FEES, PERMITS AND CERTIFICATES .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 32 12 16.01 - Asphalt Paving: Short Form
- 1.2 REFERENCES .1 Ministry of Transportation, Ontario (MTO)
- .1 Ontario Traffic Manual Book 7: Temporary Conditions - 2014.
 - .2 Manual for Uniform Traffic Control Devices (UTCD) for Streets and Highways - 2014.
- 1.3 PROTECTION OF PUBLIC TRAFFIC .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
- .1 Place equipment in position to minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Close lanes of road only after receipt of written approval from Departmental Representative.
- .1 Before re-routing traffic erect suitable signs and devices to Ontario Traffic Manual, Book 7: Temporary Conditions.
- .4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
- .1 Except when bridge is closed, provide 7m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.
 - .2 Provide 5m wide minimum temporary roadway for traffic in one-way sections through Work and on detours.
- .5 Except when bridge is closed, provide paved detours or temporary pathways, as indicated, to facilitate passage of pedestrian traffic around restricted construction area:
- .1 Place and compact mixed-in-place asphalt paving in accordance with Section 32 12 16.01 - Asphalt Paving: Short Form.
- .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of Departmental Representative.
-

1.4 INFORMATIONAL AND
WARNING DEVICES

- .1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Ontario Traffic Manual, Book 7: Temporary Conditions.
- .3 Place signs and other devices in locations recommended in Ontario Traffic Manual, Book 7: Temporary Conditions.
- .4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
- .5 Continually maintain traffic control devices in use:
 - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
 - .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.5 CONTROL OF PUBLIC
TRAFFIC

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to Ontario Traffic Manual, Book 7: Temporary Conditions for situations as follows:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .5 For emergency protection when other traffic control devices are not readily available.
 - .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .7 At each end of restricted sections where pilot cars are required.

- .8 Delays to public traffic due to contractor's operators: 15 minutes maximum.

1.6 OPERATIONAL
REQUIREMENTS

- .1 Maintain existing conditions for watercraft traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Departmental Representative to protect and control public traffic, existing conditions for watercraft traffic to be restricted as follows:
 - .1 Works shall not interfere with public use and operation of the Trent-Severn Waterway in Peterborough, Ontario during navigation season of 2019 and 2020. The waterway must be clear of construction materials and navigation traffic must not be obstructed from crossing along the canal during this period. Dates of navigation season are as per Section 01 14 00 - Work Restrictions.
 - .2 The duration of the road closure to vehicular traffic across the Warsaw Road Swing Bridge must be kept to a minimum during the construction period.
 - .3 There is limited and/or restricted access to adjacent lands not owned by Parks Canada in the immediate vicinity to the work site.
 - .4 Road closed to public traffic and adjacent approach roadway areas. The pedestrian and vehicular detour must be in place and required detour signs placed along the specified detour route.
- .2 Warsaw Road Swing Bridge Closure Locations:
 - .1 On West side of the swing bridge, barricades and signage are to be installed at the intersection of Parkhill Road East and the gatehouse parking entrance.
 - .2 On East side of the swing bridge, barricades and signage are to be installed at the intersection of Parkhill Road East and Canal Road.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 VEHICLE DETOUR ROUTE .1 The Contractor shall co-ordinate with the local municipalities and notify them of any closures two weeks prior to the closure date.
- .2 The Contractor will be responsible for setting up the detour route in addition fabricating and

PART 1 - GENERAL

- 1.2 REFERENCES
- .1 Canada Labour Code, Part 2, Canada Occupational Health and Safety Regulations.
 - .2 Canadian Standards Association (CSA International):
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
 - .3 2015 National Building Code of Canada (NBCC 2015)
 - .1 NBCC 2015, Division B, Part 8 - Safety Measures at Construction and Demolition Sites.
 - .4 2010 National Fire Code of Canada (NFCC 2010)
 - .1 NFCC 2010, Division B, Part 5 - Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
 - .5 Province of Ontario:
 - .1 Occupational Health and Safety Act revised Statutes of Ontario 1990, Chapter 0.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended - updated 2016.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.
 - .6 Treasury Board of Canada Secretariat (TBCS):
 - .1 Treasury Board, Fire Protection Standard April 1, 2010
www.tbs-sct.gc.ca/pol/doc-end.aspx?id=17316§ion=text.
 - .7 Site Specific Designated Substances and Hazardous Materials Survey Report (See Appendix F).
 - .8 Basic Impact Analysis (See Appendix D).
- 1.3 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
 - .3 Measures and control to be implemented to address identified safety hazards and risks.
 - .3 Submit 2 copies of Contractor's authorized representative's work site health and safety
-

- inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
 - .5 Submit copies of incident and accident reports.
 - .6 Submit WHIMS MSDS - Material Safety Data Sheets (MSDS) to Departmental Representative.
 - .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
 - .8 Departmental Representative's review of Contractor's final Health and Safety plan shall not be construed as approval and does not reduce the Contractor's full responsibility for construction Health and Safety.
 - .9 PCA Health and Safety Attestation must be reviewed and signed by Contractor prior to commencement of the Work.
 - .10 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
 - .11 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.
 - .12 Contractor's and Sub-contractor's Safety Communication Plan.
 - .13 Submit names of personnel and alternates responsible for site health and safety.
 - .14 Submit records of health and safety meetings when requested.
 - .15 Submit Workplace Safety and Insurance Board (WSIB) - Experience Rating Report.
 - .16 Provide a fire safety plan specific to work location.
 - .17 Conform to requirements noted in Site Specific Designated Substances, Hazardous Materials Survey and Basic Impact Analysis.
-

- .18 Submit other data, information and documentation upon request as stipulated elsewhere in this section.
 - .19 Refer to Section 01 11 00 - Summary of Work subsection 1.17 - CONSTRUCTION SAFETY MEASURES.
- 1.4 FILING OF NOTICE
- .1 File Notice of Project and other Notices with provincial authorities prior to commencement of Work.
 - .2 Upon request, Departmental Representative will provide name and mailing address of provincial department to whom the Notice of Project shall be sent.
 - .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.
- 1.5 HAZARD ASSESSMENT
- .1 Implement and carry out a site specific health and safety hazard assessment program as part of the work. Program to include:
 - .1 Initial hazard assessment carried out immediately upon notification of contract award prior to commencement of Work.
 - .2 Ongoing hazard assessments performed during the progress of work identifying new or potential health risks and safety hazards not previously known. As a minimum, hazard assessments shall be carried out when:
 - .1 New sub-trade work, new sub-contractor(s) or new workers arrive at the site to commence another portion of the Work.
 - .2 The scope of the work has been changed by Change Order.
 - .3 Potential hazard or weakness in current health and safety practice are identified by Departmental Representative or by an authorized safety representative.
 - .3 Hazard assessments to be project and site specific, based on review of contract documents, site and weather conditions.
 - .4 Each hazard assessment to be made in writing. Keep copies of assessments on site for duration of work. Upon request, make available to Departmental Representative for inspection.
- 1.6 MEETINGS
- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. Have Contractor's Site Superintendent in attendance. Departmental Representative will coordinate with Contractor's
-

Health and Safety Representative to determine time and location of meeting.

- .2 Provide site safety orientation session to all workers and other authorized persons prior to granting them access to work site. Brief persons on site conditions and on the minimum site safety rules in force at the site.
- .3 Conduct site-specific occupational health and safety meetings during the entire work as follows:
 - .1 Formal meetings on a minimum monthly basis.
 - .2 Informal "tool box" meetings on a regular basis from a predetermined schedule.
- .4 Keep workers informed of anticipated hazards, on safety practices and procedures to be followed and of other pertinent safety information related to:
 - .1 Progress of work;
 - .2 New sub-trades arriving on site; and,
 - .3 Changes in site and project conditions.
- .5 Record and post minutes of meeting. Make copies available to Departmental Representative upon request.

1.7 REGULATORY
REQUIREMENTS

- .1 Comply with Acts and regulations of the Province of Ontario and as indicated in 01 41 00 - Regulatory Requirements.
- .2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 GENERAL
REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Health and Safety Plan shall contain the following three (3) parts:
 - .1 Part 1: List of individual health risks and safety hazards identified by hazard assessments.
 - .2 Part 2: .1 List of specific measures to control or mitigate each hazard and risk identified in part one of Plan. Describe the engineering controls, personnel protective equipment and safe work practices to be implemented and followed when performing work related to each identified hazard or risk.
 - .3 Part 3: Emergency Measures and Communications Procedures as follows:

- .1 Emergency Measures: on-site operating procedures, evacuation measures and emergency response to be implemented in the occurrence of an incident. Procedures to be specific and relevant to identified hazards. Measures to complement and be integrated with the facility and tenants Emergency Response Plans in place at site. Obtain information on existing emergency and evacuation plans from Departmental Representative and incorporate appropriate data.
- .2 Communication Procedures:
 - .1 List of names and telephone numbers of designated officials, to be contacted should an incident or emergency situation occur, including the following:
 - .1 General Contractor and all Subcontractors.
 - .2 Federal and Provincial Departments and local emergency resources organizations, as applicable laws and regulations.
 - .3 Departmental Representative will provide list of names to be included.
 - .2 Procedures implemented at site to communicate and share information between workers, subcontractors, and General Contractor on work activities and in particular those which might endanger workers and Facility employees.
 - .3 List of critical construction activities to be communicated with the Parks Canada representatives which could affect facility operations, or pose a risk to the health and safety of their employees and to the general public. Develop list in consultation with the Departmental Representative.
- .3 Prepare Health and Safety Plan in a three column format, addressing the three parts specified above, as follows:

Column 1	Column 2	Column 3
Identified Hazard	Control Measures Implemented	Emergency Measures and Communication Procedures

- .4 Develop Health and Safety Plan in collaboration with all subcontractors. Address all work and

activities of subcontractors as they arrive on site. Immediately update Plan and submit to Departmental Representative.

- .5 Implement, maintain and enforce compliance with requirements of the Health and Safety Plan until final completion of work and demobilization from site.
- .6 As work progresses, review and update Plan addressing additional health risks and safety hazards identified by on-going hazard assessments.
- .7 Submit revised versions of Plan to Departmental Representative.
- .8 Post a typed written copy, including all updates of the Health and Safety Plan in a common visible location at work site.
- .9 Submission of the Health and Safety Plan, and updates to the Departmental Representative is for review and information purposes only. Its submission shall not be construed to imply approval by Departmental Representative, be interpreted as a warranty of being complete, accurate and legislate compliant and shall not relieve the Contractor of his legal obligations for the provision Health and Safety of the Construction Project.
- .10 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by the Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended and Ontario Regulations for Construction Projects, O. Reg. 213/91.

- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations made under part II of the Canada Labour Code.
 - .3 Observe and enforce construction safety measures required by:
 - .1 CAN/CSA S6-14 (R2016), Canadian Highway Bridge Design Code;
 - .2 Provincial Worker's Compensation Board;
 - .3 Municipal Statutes and Ordinances.
 - .4 In event of conflict between any provisions of above authorities the most stringent provision shall apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
 - .5 A copy of the Canada Labour Code Part II may be obtained by contacting:
Canadian Government Publishing
Public Services and Procurement Canada
Ottawa, ON, K1A 0S9
Tel: (819) 956-4800 or 1-800-635-7943
- 1.11 UNFORSEEN HAZARDS
- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction. Advise Departmental Representative verbally and in writing.
 - .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.
- 1.12 HEALTH AND SAFETY COORDINATOR
- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have prior site-related working experience specific to activities.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
-

-
- .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.
- 1.13 POSTING OF DOCUMENTS .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.
- .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative of Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour Office.
 - .8 WHIMS MSDS - Material Safety Data Sheets.
 - .9 Written Emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury at Work" poster.
 - .13 Location of toilet and cleanup facilities.
- 1.14 CORRECTION OF NON-COMPLIANCE .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.
- 1.15 BLASTING .1 Blasting or other use of explosives is not permitted.
- 1.16 POWER ACTUATED DEVICES .1 Use power actuated devices by qualified personnel as per manufacturer's safe operation manual.
- 1.17 WORK STOPPAGE .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Competent Supervisor to stop or start Work when, at Competent Supervisor's discretion, it is necessary or
-

advisable for reasons of health or safety.
Departmental Representative may also stop Work for
health and safety considerations.

- 1.18 SITE CONTROL AND ACCESS
- .1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop unauthorized persons from circulating within construction areas and remove from site.
 - .2 Implement procedures for granting permission to enter into work site to all persons who require access. Procedures to include the provision of a site safety orientation session.
 - .3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, hoarding and temporary lighting as required. See Section 01 56 00 - Temporary Barriers and Enclosures.
 - .4 Erect signage at entry points and at other strategic locations around site, clearly identifying construction area(s) as being "off limits" to unauthorized persons. Signage must be professionally made in both official languages or by use of well-understood graphic symbols.
 - .5 Secure site at night time or provide security guard(s) as deemed necessary to protect site against entry.
 - .6 Ensure persons granted access are fitted and wear appropriate personnel protective equipment (PPE). Be responsible for the provision of such PPE to persons who require access to conduct work or perform inspections.
- 1.19 PROTECTION
- .1 Provide temporary facilities for protection and safe passage of public pedestrians and vehicular traffic around adjacent work site.
 - .2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.
 - .3 Carry out work placing emphasis on health and safety of public, site personnel and protection of the environment.
 - .4 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.
-

-
- 1.20 PERMITS
- .1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.
 - .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain Departmental Representative's approval to proceed prior to carrying out that portion of the work.
- 1.21 MINIMUM SITE SAFETY RULES
- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements at the work site and obeyed by all persons granted access:
 - .1 Wear personal protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat and safety footwear. Wear eye protection where appropriate.
 - .2 Immediately report unsafe activities, conditions, near-miss accidents, injuries and damages.
 - .3 Maintain site in tidy condition.
 - .4 Obey warning signs and safety tags.
 - .2 Brief workers on site safety rules, and on the disciplinary measures to be taken for violation or non-compliance of such rules. Post such information on site.
- 1.22 TOOLS AND EQUIPMENT SAFETY
- .1 Implement and follow a scheduled tool and equipment inspection/maintenance program at work site. Regularly check tools, equipment and machinery for safe operation and perform maintenance at pre-established time and frequency intervals as recommended by manufacturer. Include sub-contractors equipment as part of the inspection process.
 - .2 Use standardized checklists to ensure established safety checks are stringently followed.
 - .3 Immediately tag and remove items found faulty or defective off site.
 - .4 Maintain written documentation on each inspection. Make available to Departmental Representative upon request.
- 1.23 HAZARDOUS PRODUCTS
- .1 Comply with requirements of Workplace Hazardous Materials Information Systems (WHMIS).
-

- .2 Keep MSDS data sheets on site. Provide copies of all data sheets to Departmental Representative upon receipt of materials on site.
- .3 Put a copy of all MSDS data sheets on site, in a common area, visible to workers.

1.24 PROJECT / SITE
CONDITIONS

- .1 The following are known or potential project related safety hazards at site:
 - .1 Overhead Power Lines.
 - .2 Excavations and Trenches.
 - .3 Environment (Extreme Weather).
 - .4 Steep Embankments.
 - .5 Silica in concrete.
 - .6 Lead in paint, flashing, solder in electronic equipment, solder caulking in ball fittings of cast iron pipes, vent and pipe flashings. Benzene in fuel oil, paints and adhesives.
 - .7 Guano on steel sections, tops of pier and abutments.
 - .8 Working near and around water.
 - .9 Arsenic and acrylonitrile in paints and adhesives.
 - .10 Vinyl chloride in pipes, conduits and interior finishes.
 - .11 Working at height near a lock.
 - .12 Working on or adjacent to moveable equipment (i.e movable bridge). Electrocutation.
 - .13 Unpredictable water currents in canal entrance.
 - .14 Vehicular traffic.
 - .15 Exposure to boat traffic during 2019 and 2020 navigation season.
 - .16 Confined spaces in crawl spaces.
- .2 Obtain from Departmental Representative, copy of MSDS Data sheets of existing hazardous materials stored on site or being used by Facility and Tenant personnel in the course of their operations.
- .3 Above lists shall not be construed as being complete and inclusive of safety and health hazards encountered as a result of Contractor's operations during the course of work. Include above items into the hazard assessment program specified herein.

1.25 INCIDENT AND
ACCIDENT REPORTING

- .1 Investigate and report incidents and accidents as outlined in Provincial Occupational Safety and Health Act and Regulations.
- .2 Investigate and immediately report to Departmental Representative incidents and accidents which results, or has the potential of resulting in:
 - .1 Injuries requiring medical aid.
 - .2 Property damage in excess of \$5,000.00.

.3 Required notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable regulations.

.3 Medical aid in above clause shall have the same meaning as the term "medical aid injury" as defined in the Canadian Dictionary of Safety Terms - 1987 issue, from the Canadian Society of Safety Engineers (C.S.S.E.) as follows:

.1 Medical Aid Injury: any minor injury the cost of which is covered by Workplace Safety and Insurance Board of the province in which the injury was incurred.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling
 - .2 Section 32 15 60 - Roadway Dust Control
- 1.2 REFERENCES
- .1 Canadian Council of Ministers of the Environment (CCME), Environmental Quality Guidelines
 - .2 Canadian Environmental Protection Act
 - .3 Environment Canada, Section 36(3) of the Fisheries Act, prohibits the planned or accidental discharge of deleterious substances to waters frequented by fish
 - .4 Environment Canada, Migratory Birds Convention Act, prohibits the deposit of oil, oil wastes, or other substances harmful to migratory birds or in any area frequented by birds and the harm of any migratory bird or its nest
 - .5 Species at Risk Act
 - .6 Ontario Environmental Legislation
 - .7 Environmental Protection Act of Ontario
 - .8 Environmental Standards and Guidelines Document, Ontario Waterways, Parks Canada Agency, July 2017
 - .9 Historic Canals Regulations, SOR/93-220, Department of Transportation Act, May 1993
 - .10 Ontario Water Resources Act, Province of Ontario, R.S.O., 1990
 - .11 Ontario Provincial Standard Specification .1 OPSS 805, November 2010, Construction Specification for Temporary Erosion and Sediment Control Measures.
 - .12 Historic Canal Regulations apply to and govern work under this Contract. Regulations may be obtained from Justice Canada's website at: http://laws-lois.justice.gc.ca/eng/regulations_sor-93-220/
 - .13 Changes to project scope of work not assessed under the EMP and BIA will require review and acceptance by Departmental Representative and May require issuing revised EMP and/or permit.
- 1.3 DESCRIPTION
- .1 This Section describes requirements for the protection of archaeological and cultural resources and the environment that apply to the
-

Work. These requirements apply to all Sections of this Specification, without limiting the conditions and approvals imposed by statute.

- .2 Control work to provide effective environmental protection. Departmental Representative will monitor environmental protection measures and will identify whenever such protection is found to be ineffective. Change protective measures or work procedures as directed by Departmental Representative to ensure environmental protection.
- .3 Comply with the environmental requirements of Contract Documents, applicable federal, provincial, and local statutes, acts, regulations, and ordinances of Agencies having jurisdiction.
- .4 The Trent-Severn Waterway is a National Historic Site of Canada.
- .5 Includes work to protect archaeological and cultural resources, and provide environmental protection including but not limited to:
 - .1 Implementing mitigation measures from EMP and Basic Impact Assessment (BIA);
 - .2 Including but not limited to installation, maintenance, and removal of turbidity curtains, erosion controls, sediment controls, dewatering, dust control and ground protection measures;
 - .3 Environmental testing, and other environmental procedures.

1.4 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to human; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
 - .3 Drip Line: location on the ground surface directly beneath a theoretical line described by the tips of the outermost branches of the trees.
 - .4 Barrier: fence consisting of approved material, supported by steel posts and being a minimum of 1.8m high, without breaks or unsupported sections.
-

- .5 Deleterious Material: any substance that, if added to a waterbody, could degrade water quality or impact fish, fish habitat and aquatic wildlife. This includes, but is not limited to:
 - .1 Concrete dust
 - .2 Soils (clay, silt, sand)
 - .3 Oil, diesel, or gasoline
 - .4 Chipped or fresh mortar, concrete admixtures
 - .5 Alkali water resulting from fresh concrete or cementitious grout
 - .6 Salt
 - .7 Solvents

1.5 CANAL REGULATIONS
AND PERMITS

- .1 "Historic Canal Regulations" apply to and govern work under this contract.
- .2 Regulations may be obtained from Justice Canada's website at:
<http://laws-lois.justice.gc.ca/eng/regulations/sor-93-220/>
- .3 Contractor shall not mobilize or begin any work until Parks Canada issues permit under Historic Canals Regulation (SOR/93-220 Sections 11, 14, and 15)
 - .1 Permit will not be issued before following submittals are submitted and accepted:
 - .1 Environmental Management Plan (EMP)
 - .2 Dewatering plan
 - .3 Site Specific Health and Safety Plan
 - .4 Site Layout Plan
 - .2 Changes to project scope of work not assessed under BIA will require review and acceptance by Departmental Representative and may require issuing revised permit.

1.6 HERITAGE
PROTECTION

- .1 Trent-Severn Waterway and Crowe Bay Dam 12, Lock 14 and Headrace Bridge are resources of other national heritage value.
- .2 Preserve heritage elements of site by executing Work without damage to site features or character defining elements.
- .3 Damage to heritage elements will not be tolerated.
- .4 Notify Departmental Representative immediately where there is reasonable concern that damage may result from work.
- .5 Notify Departmental Representative and PCA Environmental Authority immediately if heritage items are damaged.
- .6 Employ minimal intervention approach for all Work.

- .7 Access roads, staging areas, and work pads require review and approval.
- .8 Ensure appropriate supervision work, adequate training for workers, and other necessary precautions to protect existing structures.
- .9 Contractor may propose alternative work methodologies to be accepted by Departmental Representative and PCA Environmental Authority.
- .10 Protect possible archaeological and cultural resources by excavating only to limits indicated.
 - .1 Excavation beyond indicated limits requires acceptance by PCA Environmental Authority.

1.7 RELICS AND ANTIQUITIES

- .1 Corner stones and their contents, buried artifacts, remains and evidence of ancient persons and peoples, commemorative plaques, and other objects of historic value and worth, remain property of the Crown. Protect and notify Departmental Representative immediately of discovery of such objects.

1.8 ARCHAEOLOGICAL AND CULTURAL REQUIREMENTS AND RESTRAINTS

- .1 Site may contain possible cultural and archaeological resources.
- .2 PCA Environmental Authority may monitor and record some or all aspects of excavations, site access routes, and disturbances to soil overburden due to equipment and general work operations.
- .3 Cease Work immediately in affected Work area and notify Departmental Representative if cultural resources, suspected archaeological resources, or character-defining elements are uncovered or damaged during Work.
- .4 Do not resume Work until directed by Departmental Representative.
- .5 Proceed with other work and wait further direction for work in affected area from Departmental Representative on how to proceed.
- .6 Allow Departmental Representative and PCA Environmental Authority Representative full access to affected Work area and cooperate to provide reasonable facilities for such access.

- 1.9 HISTORICAL AND ARCHAEOLOGICAL CONTROL
- .1 Provide protection for historical, archaeological, cultural, and biological/vegetation resources in accordance with approved EMP.
 - .2 Accommodate PCA Cultural Resource Management (CRM) representatives' needs for documentation of existing structures after discovery.
 - .3 Include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative to address situations where such resources not known to be on site are discovered during construction.
 - .4 Should any archaeological or cultural resource be discovered while excavation, stop work. Contact Departmental Representative for direction prior to continuing work.
- 1.10 NOTIFICATION
- .1 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial, or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Management Plan.
 - .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
 - .2 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
 - .3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
- 1.11 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Prior to commencing construction activities or delivery of materials to site, Contractor is required to submit Environmental Management Plan (EMP) for review and approval by Departmental Representative and Parks Canada that outlines the measures to be implemented by the Contractor on the project site to eliminate or reduce environmental effects and address mitigation measures outlined in the BIA.
 - .1 The EMP must be prepared by a qualified professional(s), signed and submitted to PCA's Environmental Authority and the Departmental Representative for review and
-

- approval prior to mobilization to site and commencement of any work.
- .2 An EMP approved by PCA is required prior to the release of the Historic Canals Regulations Permit issued to the Contractor.
 - .3 The EMP and its component plans, must be prepared in accordance with Parks Canada Agency's Environmental Standards and Guidelines Document (ESG) - Ontario Waterways, July 2017, and BIA and BMPs.
 - .4 In order to allow for the timely commencement of project activities, the EMP can be submitted as separate components as project details become available.
 - .5 The EMP, or its components, shall be submitted in writing prior to the implementation of project activities and must be approved by Parks Canada and Departmental Representative.
 - .6 The EMP shall demonstrate the Contractor's understanding of the legislative context and PCA ESG document and BIA, and must provide a comprehensive overview of known or potential environmental issues to be addressed during construction tasks detailing all proposed methods, strategies, structures, facilities, equipment and systems critical to environmental protection; all proposed environmental protection and mitigation measures, monitoring and follow-up activities; all relevant standards and guidelines and all performance criteria applicable to the project.
 - .7 The complexity and level of detail in the EMP shall be proportionate to the scope of work and level of complexity and risk involved.
 - .8 EMP to detail frequency of monitoring and high-risk construction activities requiring environmental professional on site.
 - .9 EMP to be prepared in accordance with requirements of Federal, Provincial and Municipal laws and regulations.
 - .10 Notify Departmental Representative of proposed changes to project plans or schedules effecting EMP.
 - .11 Contractor to ensure on-site personnel are aware of, and comply with prescribed mitigation measures in EMP.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
 - .4 Environmental Management Plan to include:
 - .1 The purpose and scope of the EMP;
 - .2 A project overview;
-

- .3 A construction plan and schedule;
 - .4 The roles and responsibilities of the environmental management team;
 - .5 Names of persons responsible for ensuring adherence to Environmental Management Plan;
 - .6 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site;
 - .7 Names and qualifications of persons responsible for training site personnel;
 - .8 Descriptions of environmental protection personnel training program;
 - .9 Environmental awareness, training and competency commitments;
 - .10 General communications and record keeping commitments;
 - .11 Environmental incident reporting procedures;
 - .12 Environmental monitoring and adaptive management summary; and EMP review and revision procedures;
 - .13 The EMP shall address the following components likely to be affected: water quality, fish and fish habitat, vegetation, wildlife, species at risk, invasive species, noise and health and safety. Refer to ESG Document Part 2.
 - .14 The EMP Component Plans should describe the mitigation measures to be implemented during Pre-Construction, Construction, and Post-Construction work activities in compliance with the PCA ESG document ESG-1-C to ESG-18-C (as applicable).
 - .15 Component Plans and Key Requirements should be included in the EMP. A key requirement of each Component Plan will be a table that summarizes applicable Environmental Impact Assessment (EIA) commitments, terms and conditions of approval and relevant environmental standards and guidelines.
 - .16 EMP shall provide plans and mitigation for the installation and removal of any temporary structures (i.e. cofferdams, temporary bridges, etc.).
 - .17 Erosion and sediment control plan shall identify type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and EPA 832/R-92-005, Chapter 3. ESC plan shall also:
 - .1 Identify the key point and non-point sources of contaminants.
 - .2 Surface water drainage patterns.
 - .3 Sensitive erosion and sedimentation during each phase of the work.
-

- .4 Describe mitigation requirements, maintenance and monitoring program.
 - .18 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .19 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
 - .20 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .21 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .22 Spill Control Plan to describe the on-site role and responsibilities for spills and emergency response. Include contents and location of spill kits.
 - .23 Up-to-date emergency response contact list including contact information for reporting spills.
 - .24 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .25 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
 - .26 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
 - .27 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection
-

- water, hydrostatic test water, and water used in flushing of lines.
- .28 Vegetation that is to be removed should be outlined (diagram) and kept to a minimum.
 - .29 Trees that are required to be removed should be clearly identified and justification of removal should be made clear. Tree removal and pruning should be kept to a minimum.
 - .30 Vegetation and trees that are removed shall be replaced or compensated for, and outlined within a Re-Vegetation Plan.
 - .31 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
 - .32 Plant and Tree Protection Plan (including plan to restore all vegetated areas disturbed by construction activities to original conditions or better).
 - .33 Invasive/Alien species control plan (i.e., preventative measures to avoid bringing invasive species to the site).
 - .34 Wildlife Protection Plan to describe mitigation requirements, maintenance and monitoring program.
 - .35 Pesticide treatment plan to be included and updated, as required.
 - .36 Conform to requirements identified in Basic Impact Analysis (See Appendix D).
 - .37 Demolition:
 - .1 Provide schedule for demolition works. Describe the procedures.
 - .2 Describe mitigation requirements, maintenance and monitoring program.
 - .38 Site Dewatering and Wastewater:
 - .1 Describe the methods equipment and materials to be used including control measures.
 - .2 Provide schedule. Specify water quality discharge criteria and point of discharge
 - .3 Describe mitigation requirements, maintenance and monitoring program
 - .4 Provide design, installation, operation and removal of dewatering structures and dewatering systems, to be updated as required.
 - .39 Aquatic Resources Management:
 - .1 List the methods, strategies to be used for aquatic resources management.
 - .2 Describe mitigation requirements, maintenance and monitoring program.
 - .3 To include fish/aquatic species rescue and relocation plan (if applicable).
-

- .4 Throughout dewatering, ensure that the dewatered portion of the Work is cleared of all stranded fish. Use nets and/or traps to catch fish. Handle fish to prevent their injury and place in buckets with ample fresh water at lake temperature until released. Release alive as soon as possible to closest body of water.
 - .40 Species at Risk Protection:
 - .1 Identify Species at Risk, critical habitat or areas to be protected.
 - .2 List the methods, strategies to be used for SAR and critical habitat management.
 - .3 Tabulate EIA commitments. Refer to ESG Document Part 2.
 - .4 Describe mitigation requirements, maintenance and monitoring program.
 - .41 Hazardous Materials and Concrete Waste Management Plan:
 - .1 Identify and describe location of hazardous materials storage facilities on-site.
 - .2 Provide and inventory and MSDS for all hazardous materials to be used on site.
 - .3 Provide inventory and location of spill equipment to be stored on-site.
 - .4 Tabulate EIA commitments. Refer to ESG Document Part 2.
 - .5 Describe mitigation requirements, maintenance and monitoring program.
 - .42 Fuel Management:
 - .1 Describe the fuel handling, transfer and storage procedures. Provide equipment refueling plans.
 - .2 Describe mitigation requirements, maintenance and monitoring program.
 - .5 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - 1.12 REGULATORY REQUIREMENTS
 - .1 Comply with environmental requirements of Contract Documents, applicable federal, provincial, and local statutes, acts, regulations, and ordinances of Agencies having jurisdiction.
 - .2 Owner, Parks Canada Agency, is main Environmental Authority for Trent-Severn Waterway projects.
-

- .3 Departmental Representative will seek and obtain acceptance of PCA Environmental Authority of submittals or changes in scope of work or methodologies that may affect archaeological resources, cultural resources or environment prior to providing direction to Contractor.
- .4 Owner will not issue permit to authorize start of Work, under Historic Canal Regulations, before review and acceptance of Environmental Management Plan.
- .5 Comply with and enforce compliance by employees of prescribed environmental mitigation measures outlined in Environmental Management Plan and Basic Impact Assessment (BIA) and other federal, provincial, territorial or municipal acts or regulations applying to the National Parks and Historic Sites of Canada.
- .6 Changes to project scope of work not assessed under BIA will require review and acceptance by Departmental Representative and may require issuing revised permit.
- .7 Allow PCA Environmental Authority full access to affected Work area and cooperate to provide reasonable facilities for such access.
- .8 Submit copies of environmental orders and directions to Departmental Representative.

1.13 ENVIRONMENTAL PERFORMANCE

- .1 A meeting will be held with the successful contractor at least two weeks prior to the commencement of construction activities. All Contractor staff and Departmental Representative's staff assigned to project are required to attend. Environmental protection requirements for the project will be reviewed, including, but not limited to watercourse maintenance or diversion, water quality management, soils disposal, dewatering management, related permit requirements and on-site reporting and monitoring procedures.
 - .2 The Contractor is held responsible to ensure that all necessary permits related to Environmental Management have been obtained and that necessary documentation is available on-site.
 - .3 Meet all requirements as detailed in the Basic Impact Analysis included in Appendix D. Where stipulations in Appendix D differ from those herein, the more stringent requirements shall apply. A copy of the Environmental Assessment shall be available on-site in a conspicuous location.
-

- .4 Prepare and submit the following documents as specified elsewhere in this section for review by the Departmental Representative:
 - .1 Diversion methodology.
 - .2 Construction Methodology.
 - .3 Erosion and Sedimentation Control Plan.
 - .4 Environmental/Spill Response Plan.
 - .5 Under the Canadian Environmental Protection Act, Federal Fisheries Act and Environmental Protection Act of Ontario, no sediment shall be released into any waterbody.
- 1.14 SITE SET-UP AND USE
- .1 All site activities related to construction are to be confined within the defined project boundaries.
 - .2 Equip work site with appropriate and properly maintained sanitary facilities for use by workers.
 - .3 Garbage must be collected and removed daily from the work site. All material must be removed, transported and disposed of in accordance with existing federal, provincial, and municipal solid waste disposal guidelines and/or regulations.
 - .4 Littering is prohibited.
 - .5 Temporary storage, parking areas, and turn-around facilities for contractor-related equipment and vehicles will be limited to those areas agreed to and designated by the Departmental Representative.
 - .6 Fires and burning of rubbish on site are not permitted.
 - .7 Comply with all regulations set out in the Canadian National Parks Act (S.C. 2000, C.32), in particular, the prohibition of illegal fishing, hunting and feeding of wildlife.
- 1.15 EXPLOSIVES
- .1 Use of explosives is prohibited.
- 1.16 FIRES
- .1 Fire and burning of rubbish on site is not permitted.
- 1.17 SITE CLEARING AND PLANT PROTECTION
- .1 Care shall be taken to protect existing plants, garden vegetation on site and adjacent properties.
 - .2 Limit clearing, grubbing, and tree-branch removal to areas of work or access indicated on approved shop drawings.
-

- .3 Provide barriers around trees and gardens which may be affected by work, including staging areas.
 - .1 Locate barrier 1 metre beyond Drip line.
 - .2 Barrier to consist of protective wood framework covered with plastic construction fence material, extending from grade level to a height of 2 metres.
 - .3 Maintain barriers in good repair throughout duration of Work.
 - .4 Remove barriers upon completion of Work.
 - .4 Damage to trees due to Contractor's operations to be addressed as follows:
 - .1 Broken branches 25 mm or greater in diameter: cut back cleanly at break, or to within 10 mm of their base, if substantial portion of branch is damaged Departmental Representative will direct.
 - .2 Exposed roots 25 mm or larger: cut back cleanly to soil surface within five calendar days of exposure.
 - .3 Damaged bark: neatly trim back to uninjured bark, without causing further injury, within five calendar days of damage.
 - .5 Reduce soil displacement and compaction by using heavy machinery in designated areas with proper ground protection system or on existing vehicle paths.
 - .6 Replace damaged lawn and gardens to pre-construction state with topsoil and sod and/or sod.
 - .7 Avoid using heavy machinery on saturated ground.
 - .8 Use equipment of low bearing weight and low pressure tires wherever possible.
 - .9 To minimize the risk of introducing invasive species: all soil, gravel, erosion and sediment control products (e.g. hay, straw, mulch) from outside the protected heritage place must be approved by the designated Parks Canada staff.
 - .10 Minimize stripping of topsoil and vegetation. Vegetation should not be cleared unless approved by Departmental Representative.
 - .11 Bulldozers, graders, and other clearing and grubbing equipment should not be operated outside of designated clearing boundaries and should have a restricted turning radius.
 - .12 Vegetation and topsoil should not be removed to obtain fill for road construction purposes.
-

- .13 Restrict tree removal to areas indicated or designated by Departmental Representative.
 - .14 Trees and other vegetation outside the limits indicated on the drawings should not be cut or removed; trees or snags posing a danger to operations would be an exception.
 - .15 Trees and debris should not be permitted to fall outside cleared areas or into water courses.
 - .16 Whenever possible, organic debris removed during grading operations should be stored for use during site restoration. Such stockpiles should be located well away from any stream or water body and should be covered with coarse material or tarps to minimize wind and water erosion.
 - .17 Excavation for installation of new work grubbing operations should only be carried out where required. The vegetative mat should be disturbed in the grubbing operations area only.
 - .18 Should tree removal be required (alternative options for preservation not feasible), justification for removal should be provided within EMP.
 - .19 Where work restrictions impede placement of vegetation protective barriers, seek acceptance of Departmental Representative and PCA Environmental Authority for alternative solutions.
 - .20 Cut trees at ground level and do not leave pointed stumps.
 - .21 No vegetation clearing to occur between April 1st and August 31st of any year to protect nesting birds.
If vegetation clearing must take place during this period, an avian biologist must be present to screen and clear the area of nests no more than (2) days prior to clearing.
 - .22 Provide inventory of species removed, and a replanting plan using native species to be accepted by Departmental Representative and PCA Environmental Authority in cases of removing mature vegetation.
 - .23 Keep site stabilized if there is less than four weeks remaining in growing season.
 - .24 Visual site inspections to be conducted in spring and fall for first two growing seasons following planting. If any plantings are found dead or
-

failing, mitigation measures to be implemented to reduce risk of future failure and plants to be replaced and monitored accordingly.

- .25 Grubbing should not be conducted unless a suitable planting plan and Erosion and Sediment Controls are in place.
- .26 Delineate areas to be avoided with flagging tape or temporary fences.
- .27 Ensure appropriate handling procedures are followed for noxious weeds such as Giant Hogweed or Wild Parsnip.
- .28 In the event that the installation of root-protective fencing is not possible and/or ideal, alternative measures, as approved must then be implemented. Such measures must provide sufficient amount of soil compaction prevention with regards to the highest level of activity to occur within the immediate area of protection.
 - .1 For areas of light-to-medium levels of traffic activity, a geotextile cloth shall be placed over the area of protection and covered with 200 mm, minimum, thick layer of wood mulch material.
 - .2 Pins or staples must be used to secure the geotextile material to the ground.

1.18 WILDLIFE MITIGATION

- .1 In the event that an unexpected wildlife situation arises or a species at risk is found on site or encountered during construction activities, all work will cease and a Parks Canada representative will be contacted immediately to assist with mitigation measures.
- .2 Possible species at risk and wildlife encounters include but are not limited to: nesting birds, roosting or hibernating bats, and basking or hibernating snakes.
- .3 Detail procedures for preventing turtle entry and nesting within disturbed project area in EMP.
- .4 Place temporary reptile exclusion fencing around stockpiled material and construction areas that may attract turtle nesting activities. Reptile exclusion fencing must follow the guidance in the document titled Species at Risk Branch, Best Practices Technical Note, Reptile and Amphibian Fencing, ver.1.1, developed by the Ontario Ministry of Natural Resources and Forestry: http://files.ontario.ca/environment-andenergy/species-atrisk/mnr_sar_tx_rptl_amp_fnc_en.pdf

- .5 Environmental Management Plan to detail procedures for avoiding disturbance to wildlife and nesting birds, and Species at Risk.
- .6 Do not use synthetic plastic erosion control mats or blankets to reduce potential for entrapment hazard for wildlife.
- .7 Standard sediment fencing on site should not have mesh/netted backing.
- .8 Retain the services of a qualified biologist to educate workforce on potential wildlife which could occur in the vicinity of the work area and measures to avoid wildlife.
- .9 Removal of woody vegetation will not occur during the breeding bird season from April 1st to August 31st inclusive, unless a qualified biologist has searched the site for nests and concluded that no nests are present, no more than 7 days prior to clearing. If nests are found, a protective buffer around the nest location will be required until such time that the nest is abandoned.
- .10 When possible, complete work during daylight. If nighttime lights are used, they are to be installed so as to illuminate the work area only to minimize impacts to nighttime activities of wildlife.

1.19 OPERATION AND
MAINTENANCE OF EQUIPMENT

- .1 Equipment and heavy machinery to meet or exceed applicable emission requirements.
 - .2 Leave machinery running only while in actual use, except where extreme temperatures prohibit shutting machinery down.
 - .3 Vehicle and equipment maintenance and refueling to be conducted over impermeable/absorptive material situated at a designated area that is located at least 30 m away from nearest waterway.
 - .4 Provide drip trays to prevent the discharge oil, grease, antifreeze, or any other materials into the ground.
 - .5 Drip trays shall be placed under all fuel-run machinery on site and any equipment with potential to leak deleterious fluids (i.e hydraulic fluids). Drip trays shall be sized to encompass the perimeter of the machinery/equipment and shall provide ample spacing for refueling activities.
 - .6 In case of fuel heaters to be located with 30 m of a body of water, use large drip pan to contain
-

possible leakage from heater or refueling operations. Absorptive material to be placed at bottom of drip pan for added measure.

- 1.20 REMOVED MATERIALS .1 Unless otherwise specified, materials designated for removal become Contractor's property. Remove these from site.
- 1.21 WORK IN AND ADJACENT TO WATERWAYS .1 Work adjacent waterways to be conducted in accordance with the Conservation Authorities Act of Ontario.
- .2 Construction equipment to be operated on land only.
- .3 Use waterway beds for borrow material only after written receipt of approval from Departmental Representative.
- .4 Waterways to be kept free of excavated fill, waste material and debris.
- .5 Do not operate construction equipment in waterways. Fording of watercourses is not permitted.
- .6 Do not use waterway beds for borrow material.
- .7 Do not dump excavated fill, waste material or other debris in waterways.
- .8 Design and construct temporary crossings to minimize erosion to waterways.
- .9 Do not skid logs or construction materials across waterways.
- .10 All in-canal work to be approved by Departmental Representative. All in-canal work shall take place only under dewatered or low flow conditions.
- .11 Do not clean or drain equipment in waterways.
- .12 Temporary storage sites for debris generated from clearing operations should be deposited away from watercourses, should be surrounded by a natural vegetative buffer, should be screened from the road and should be selected by the Departmental Representative.
- .13 The canal is naturally dewatered seasonally in the Fall, specific dates to be confirmed by PCA.
- .14 Any fish encountered within the construction site must be removed by qualified personnel designated
-

by the Departmental Representative. Place fish barrier nets as indicated.

- .15 Do not pump or drain water containing suspended materials into waterways. Water containing suspended materials shall be pumped into vegetation a minimum of 30 m away from watercourses.
- .16 Do not use salt as a de-icer near canal. In areas where ice is a safety concern, the use of sand will be permitted, but it must not be allowed to enter the watercourse.
- .17 Stockpile excavated or fill materials must be stored and stabilized away from water.
- .18 Runoff from the excavated or fill material must be contained from entering the watercourse by sediment fencing installed 1 m out from the base and all around the stockpiled material. Stockpiled material should be covered with tarpaulin or other approved covering.
- .19 Turbidity curtains, flow checks, sediment fences, drainage swales or other methods necessary to prevent sediment or sediment from entering the canal.

1.22 DISPOSAL OF WASTE

- .1 Waste subject to Ontario Environmental Protection Act to be transported with valid "Certificate of Approval for a Waste Management System" to site approved by Ontario Ministry of the Environment to accept that waste.
 - .2 Obtain and submit Waste Generator Numbers, permits, manifests, and other paperwork necessary to comply.
 - .3 Do not bury rubbish and waste materials on site. Remove all garbage from site daily.
 - .4 Do not dispose of waste or volatile materials, such as mineral spirits or oil into waterways, storm or sanitary sewers.
 - .5 Dispose of uncontaminated construction/demolition materials which cannot be recycled or reused, at an approved construction and debris disposal site.
 - .6 Excavation, filling, pumping, towing, hauling, disposal, and dumping operations for excavation will employ such methods and equipment to ensure no loss of materials into waterways.
-

1.23 DRAINAGE

- .1 Develop and submit erosion and sediment control plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial and Municipal laws and regulations.
 - .2 Watercourse shall be maintained within construction area. Contractor to submit construction methodology to Departmental Representative before proceeding. Methodology to include excavation dewatering techniques, maintenance of watercourse flow and isolation from construction areas for duration of construction.
 - .3 Do not pump or drain water containing suspended materials into waterways, sewer or drainage systems.
 - .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
 - .5 Water shall not be pumped directly into the waterway. Send all discharge to a sealed containment basin or filtration area before being released into the waterway. Refer to ESG for waste water management. Water quality downstream of construction activities and/or released to watercourses not to exceed background turbidity readings of 8 nephelometric turbidity units (NTU), or a change of 25 mg/L for suspended solids. Refer to CCME guidelines for the protection of aquatic life.
Prior to dewatering, Contractor to submit a Dewatering Plan for approval by the Departmental Representative.
 - .6 Storm Water Pollution Prevention Plan (SWPPP) to be included in erosion and sediment control plan.
 - .7 Provide temporary drainage and pumping required to keep excavations and site free from water.
 - .8 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
 - .9 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
 - .10 Send all discharge to a sealed containment basin or filtration area, or use mechanical or chemical (polymer) treatment, as directed by the Construction Manager, before removal from site.
-

- .11 In the event of significant sedimentation or debris caused by construction activities, contractor must take appropriate measures to confine work.
 - .12 If the sediment, debris or erosion control measures are not functioning properly, no further work within the area will be permitted until the sediment / erosion problem has been rectified.
 - .13 Sediment, debris and erosion control measures shall be left in place until all disturbed areas within the work area has been settled. Sediment and Erosion control measures are to only be removed with approval from Departmental Representative.
 - .14 In-water work shall be performed in a manner that minimizes the disturbance of the watercourse bottom and dispersion of sediment.
 - .15 All erosion and sediment control methods, including those identified on the drawings, will be installed according to the erosion and sediment control plan, prior to commencement of any project activities and must remain in place until all work has been completed and disturbed areas have been stabilized.
 - .16 Develop a contingency plan (eg. Extra pumps/equipment) in the event of extreme precipitation events or spring flooding at the place of Work. Refer to ESG, Table 3 - EMP Component Plans and Key Requirements: Dewatering and Wastewater.
 - .17 Sediment, debris and erosion control measures must be inspected daily and before and after rainfall events, to ensure that they are functioning properly and are maintained and upgraded as required. Remove accumulated sediment required and dispose off site.
 - .18 In the event that sediment and erosion control measures are not functioning, the Departmental Representative will order the work stopped. Do not carry out further work until the sediment control plan is adjusted to address the sediment problem.
 - .19 Place only washed stone, free of particulate in the canal.
 - .20 Use of earth or granular material with sand and fines for any required cofferdam/water barrier structure construction is not acceptable. Washed
-

- gravel with 6 mm minimum aggregate size, contained within meter bags with waterproof liners, can be used as cofferdam / berm material. If using sandbags, sand must be washed and free of fines.
- .21 Quickly address and seal any leaks discovered in cofferdam / berm. If leaks persist, create a clean water collection area, to be pumped back to the upstream or downstream receiving waters.
 - .22 Upon completion of work, completely remove all debris from work area and stream bed. Restore the area to its original state.
 - .23 Treat any water containing a high level of sediment or sediment by discharging to sealed containment basins, vegetated areas or sediment traps prior to release to streams. Mechanical filtration i.e. filterpress or chemical - flocculation may be acceptable to the Departmental Representative. Confirm if this is an option and refer to ESG-14-C for the Treatment of Discharge Waters. Water quality downstream of construction activities and turbidity curtain should not exceed recommended CCME guidelines on water quality for the protection of aquatic life. Particularly no change from background turbidity readings of 8 nephelometric turbidity units (NTU), or a change of 25 mg/L for suspended solids, at any one time for a duration of 24 h in all waters during clear flows or in clear waters.
 - .24 Information on CCME guidelines can be obtained online at:
<http://ceggrcqe.ccme.ca/download/en/217/>. If NTU readings are found to be noncompliant, total suspended solids (TSS) may be sampled for laboratory analysis.
 - .25 In the event of significant sedimentation or escape of debris caused by construction activities, Contractor to stop work immediately, notify Departmental Representative, calls the MOE Spills Action Centre (1-800-268-6060) and take appropriate measures to confine work and modify Environmental Management Plan including installation of new environmental measures and/or additional turbidity curtains.
 - .26 Monitor water quality for suspended sediment levels exceeding identified requirements during in and near-water activities.
 - .27 CCME has set criteria wherein the allowable increase in total suspended solids (TSS) beyond background levels is 25 mg/l for short-term
-

exposure (24 hr period) and or maximum average increase of 5 mg/L for long term exposures (>24 hr to 30d).

- .1 Contractor shall provide protocol and methodologies for monitoring the TSS from any discharge point (treated or untreated) to the watercourse.
Contractor to ensure that TSS levels at points of discharge and in the receiving environment do not exceed and absolute TSS value, to be based on the background value at the site, and determined prior to construction.
 - .28 Turbidity Monitoring may be completed in conjunction with monitoring of TSS. Turbidity monitoring should be completed during dewatering discharge that is ultimately received by a surface water feature, at a minimum frequency of twice per day during active dewatering. Testing locations should be specified within the EMP and may be modified (with PCA acceptance) dependent of site activity and/or downstream effects (i.e. in the event of a plume release into the watercourse (turbidity, concrete fines, etc.) additional testing should be conducted further downstream to track the movement and dissipation of the plume through the watercourse).
 - .29 Daily turbidity records shall be maintained by the contractor and shall be provided to the Departmental Representative on a weekly basis.
 - .30 If the ESC strategies outlined on the EMP are not effective in preventing the release of a deleterious substance, including sediment, then alternative measures must be implemented to minimize potential. Changes to the EMP must be accepted by Departmental Representative and an updated EMP/Permit may be required.
 - .31 Ensure that sediment sealed containment basins are of adequate size to allow for excess sediment run-off and erosion.
 - .32 Record pH measurements of water inside and outside containment area.
 - .33 Water with pH>9 or <6 cannot be released directly into the canal, such water must be treated prior to release.
 - .34 Water with pH>12.5 is treated as a hazardous waste in accordance with Ontario Regulation 347/90 of the Environmental Protection Act and water must be removed from site.
-

- .35 Stop work in immediate area in the event pH, sedimentation or turbidity exceed identified thresholds and implement mitigation measures accepted by Departmental representative.
- 1.24 POLLUTION CONTROL
- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment to Federal, Provincial and local authorities emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads, refer to Section 32 15 60 - Roadway Dust Control. Chemicals used in dust control must have prior approval of the Departmental Representative.
- .4 Cleaning of heavy equipment, including concrete trucks, shall not be cleaned within the park boundaries.
- .5 Minimize idling of engines and equipment at all times.
- .6 Prevent sandblasting, concrete dust and other extraneous materials from contaminating air and waterways beyond application area.
.1 Provide temporary enclosures where directed by Departmental Representative.
- .7 Contractor is responsible for all costs of cleaning up any spills to the satisfaction of the Departmental Representative.
- .8 Compressed fuel tanks shall be placed off to side of work area when not in use and shall be equipped with an impact-protection barrier.
- .9 Use biodegradable hydraulic fluids for machinery that will be working in or around the canal.
- .10 Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads; provide berms and secondary containment systems as necessary.
- .11 A secondary containment system is required of all on site ASTs as per provincial and federal storage tank requirements:
<https://www.canada.ca/en/environmentclimatechange/services/canadian-environmental-protection-actregistry/publications/codepractice-storage-tank-systems/part-3.html>
-

- 1.25 EARTH MOVEMENT
- .1 Where engineering and environmental requirements can be met, excavated materials from this project may be used for backfilling, at the discretion of the geotechnical engineer designated by the Departmental Representative.
 - .2 All surplus excavated material must be disposed of at an approved location and in an approved manner.
 - .3 Any proposed sources of borrow material shall be approved by the Departmental Representative prior to start-up.
 - .4 When vegetation must be removed, then the extent and duration of exposure should be kept to a minimum. Plan the phases of development so that only areas that are activity being developed are exposed.
 - .5 Any excavated material that is to be stockpiled on site must be covered and stabilized to prevent erosion and minimize contaminated runoff. Sediment fence to be installed around stockpile.
 - .6 Areas of unstable clays should be left undisturbed.
 - .7 Dust control measures will be necessary, especially when asphalt is removed. The use of chemical dust control agents must be pre-approved by the Departmental Representative.
 - .8 Where there is potential for severe erosion and/or downstream sedimentation, cover excavations during major precipitation events as directed by Departmental Representative.
- 1.26 EROSION AND SEDIMENT CONTROL
- .1 Appropriate preventative controls shall be in place at all times during construction to prevent undue erosion and sedimentation. Provide to the Departmental Representative before start-up, an Erosion and Sedimentation Control Plan. Comply with the Ministry of Transportation Ontario's Manual entitled Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects and PCA Environmental Standards and Guidance Document. Incorporate necessary sediment fences, sediment traps, plastic lined trenches and ditches, temporary culverts or diversions as approved by the Departmental Representative. Supply, install and maintain all sedimentation and erosion control features for duration of the Work, in accordance with the accepted plan. Remove all sedimentation and erosion control upon completion of the work and
-

- when requested by the Departmental Representative.
- .2 Prior to starting work that will create dust or debris, such as improvements to access, concrete sawing, removal, excavation or backfilling, install effective mitigation techniques for erosion, sediment, dust and debris control in accordance with Federal, Provincial and Municipal laws and regulations. Maintain these protective measures at all times, including during shut down periods.
 - .3 Maintain effective surface drainage and direct runoff away from work areas and into adequately vegetated areas.
 - .4 Excavation to cease during periods of heavy rainfall, unless runoff is contained from entering waterway.
 - .5 Cover or wet down dry materials to prevent blowing dust and debris.
 - .6 The plan must cover all activities within the limits of the construction, laydown and traffic diversion areas.
 - .7 The plan must acknowledge the potential for excavated materials to be contaminated and may be a source of contaminated leachate / runoff.
 - .8 Backfilled slopes should be mechanically compacted, and grades should be consistent with the prevailing down-slope grade. Where it is felt that immediate re-vegetation is needed to stabilize an area, hydroseeding operations or other temporary stabilization measures will be carried out, as directed by the Departmental Representative.
 - .9 Prior to carrying out work, check long range weather forecast to ensure that there is adequate time before forecast of heavy rain storms to stabilize the work. Provide details of stabilization plan to Departmental Representative for review.
 - .10 Maintain a stockpile of appropriate erosion and environmental protection materials (e.g. silt fences, straw bales, wood chips, clean rock fill and aggregate base course) on site at all times.
 - .11 Supply and install additional erosion control measures as required by site conditions to prevent sediment from entering drainage courses.
-

- .12 Inspect erosion and sediment control measures on a daily basis and maintain and replace as necessary.
 - .13 Provide a 1 meter high sediment fence barrier in all areas where, due to construction activities, sediment or debris may enter the waterway. Install sediment curtain minimum 3 m from shoreline.
 - .14 Environmental protection measures shall be checked after each extreme weather event.
 - .15 Disturbed areas of the work site shall be stabilized immediately and re-vegetated as soon as conditions allow. Exposed areas should be covered with fibre-based erosion control blankets or other measures to keep the soil in place and prevent erosion until re-vegetated.
 - .16 Sediment control measures and exclusion fencing must be removed in a way that prevents the escape or re-suspension of sediments.
- 1.27 HAZARDOUS MATERIALS
- .1 Dangerous goods, whose release into the environment could cause adverse effect, should be stored and handled in a manner which gives due regard for workers and public safety, and for the protection of the environment.
 - .2 No material toxic to fish or any aquatic life shall be permitted to enter any stream, river, or lake. This shall include, but not be limited to lubricants, fuels, testing fluids, insecticides, detergents, herbicides, cement, lime or concrete.
 - .3 The management of fuels, lubricants and chemicals must meet with the requirements of the Ontario Dangerous Goods Transportation Act (RSO 1990, c. D.1) and all other appropriate provincial and federal regulations.
 - .4 Fueling and lubricating of equipment cannot be done closer than 100 m to any watercourse.
 - .5 All refueling and lubricating operations should employ protection measures such as drip pans, to reduce the potential for escape or petroleum products to the environment. Refer to ESG-13-C - Refueling and Spill Management for PCA requirements.
 - .6 The Departmental Representative must be immediately contacted after a spill of any amount of fuel or lubricant, and after any amount of other chemical products has escaped.
-

- .7 Departmental Representative may suspend work following the improper handling of hazardous materials.
 - .8 Storage of hazardous material, including explosives, shall not be permitted, except for quantities which shall normally be expected to be utilized in a day of Work, and which are not permitted to stockpile.
 - .9 Contractor to maintain on-site adequate supply of sorbent material and berming devices to contain spills.
 - .10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.
 - .11 Provide training to site personnel in the use of the spill kit.
 - .12 Spill response materials to be compatible with the type and quantity of materials being handled.
 - .13 Store hazardous materials in secure areas on impermeable pads, provide berms if necessary.
 - .14 Dispose of hazardous materials and designated substances in accordance with Ontario Regulation 347/90.
- 1.28 CLEAN-UP
- .1 Clean up work area continuously as Work progresses.
 - .2 At end of each work period, and more often if ordered by Departmental Representative, remove debris from site, neatly stack material for use, and clean up generally.
 - .3 Permit no amount of debris, trash or garbage to accumulate on site.
 - .4 Do not bury rubbish on site.
 - .5 Separate and recycle materials that can be recycled.
 - .6 Dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner by taking them to special designated waste facility. Do not dump these into storm or sanitary sewers.
-

- .7 Excess concrete must be disposed of at any appropriate facility outside of the Parks Canada protected heritage place. If excess concrete must be dumped prior to transport outside of the protected heritage place, it must be deposited in a location approved by Parks Canada and removed following hardening for disposal at an approved facility.
 - .8 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .9 Spills:
 - .1 Have environmental emergency response plan in place, spill kit and other materials readily available on-site to respond quickly if spills occur.
 - .2 Report spills immediately to Departmental Representative and Ontario Ministry of Environment Spills Action Centre (Telephone No. 1-800-268-6060).
 - .3 Secure source of spill to stop flow of spill and isolate area of spill.
 - .4 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material, or absorbent pads.
 - .5 Clean-up, remove and dispose of contaminated materials in accordance with MSDS or as directed by Ontario Ministry of Environment.
 - .6 Be responsible for costs of cleaning up spills to satisfaction of Departmental Representative.
 - 1.29 ENVIRONMENTAL INCIDENT OR EMERGENCY
 - .1 In the event of an environmental incident or emergency such as:
 - .1 Chemical spill or petroleum spill;
 - .2 Poisonous or caustic gas emission;
 - .3 Biological or chemical explosion;
 - .4 Hazardous material spill;
 - .5 Sewage spill;
 - .6 Contaminated water into waterways; or
 - .7 Turbidity release into waterway.Notify the Ministry of Environmental Spills Action Center and Departmental Representative.
 - .2 The Contractor is to submit to Departmental Representative a copy of its Environmental/Spill Response Plan for approval.
 - .3 Should conditions at the work site indicate that there are unforeseen negative impacts to fish or their habitat, cease all work until the problem has been corrected and/or appropriate guidance has been obtained from Parks Canada.
-

-
- 1.30 TREATED WOOD
- .1 Creosote is not approved for use in Parks.
 - .2 Make workers aware of the possible health risks associated with exposure to CCA or creosote treated timber as well as the recommended safe practices for handling such materials.
 - .3 Dispose of treated wood wastes including saw-dust outside of the Park, and in accordance with all applicable Provincial and Municipal regulations. Attention to disposal of replaced guiderail posts that have been treated with creosote.
- 1.31 CLEANING OF CONCRETE EQUIPMENT
- .1 Departmental Representative will designate cleaning area for equipment and tools to limit water use and control runoff.
 - .2 Cleaning area to be no closer than 30 m from waterway to prevent contamination.
 - .3 Where no safe cleaning area is available, Contractor to provide sealed containment basin for area where equipment to be cleaned.
 - .4 Alkali water, such as concrete wash water, to be collected and disposed off-site in accordance with federal, provincial, and local authority requirements.
 - .5 Use only trigger operated spray nozzles for water hoses.
 - .6 As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars and other Portland cement or lime-containing materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse. Concrete materials cast in place must remain inside formed structures. Concrete waste water must be removed from site. Refer to ESG-5-C - Concrete Pour Operations and Grouting and strictly follow the defined guidelines.
 - .7 Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment and other tools and equipment.
 - .8 Dispose of all concrete wash water in a location where it will not enter subsurface drains, water bodies or storm drains.
 - .9 Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment
-

washing from directly or indirectly entering any watercourse.

- .10 Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient temperature is below 0°C.
- .11 In accordance with the ESG, isolate and hold any water that contacts uncured or partly cured concrete, until the pH is between 6.5 and 9.0 pH units, and the turbidity levels are acceptable. Employ CO2 treatment as outlined in ESG-5-C - Concrete Pour Operations and Grouting.
- .12 Filter material will consider the grain size characteristics of the concrete sediment and shall be designed around the principals of maintaining sufficient hydraulic flow and prevention of particle movement through the material.

1.32 SITE
DECOMMISSIONING

- .1 Unless prior permission from the Departmental Representative is obtained, all contractor equipment, facilities and materials must be removed from the site at the finish of each work phase, or if work is suspended due to weather or other circumstances, upon the suspension of work activities.
- .2 All work sites must be returned to a neat and tidy condition upon site abandonment.
- .3 Remove all scaffolding, temporary protection, surplus materials, tools, plant, rubbish and debris and dispose of them in an approved manner off Crown property by the completion date of the Work.
- .4 Clean areas under Contract to a condition at least equal to that previously existing and to approval of Departmental Representative.

1.33 HISTORICAL /
ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.
- .3 Minimum Precautions:
 - .1 Obtain diagrams and maps of previously disturbed areas and areas of concern from Departmental Representative.
 - .2 Use previously disturbed areas (eg. lawns, parking lots) immediately adjacent to the locks, to mitigate possible impact of heavy equipment and/or of staging area(s).
 - .3 Confine heavy machinery to a minimal area, to mitigate impact on potential archaeological structures.
- .4 Cease work immediately in the event that previously undocumented archaeological resources are discovered during construction and a licensed archaeologist will be contacted by the Departmental Representative to complete archaeological assessment.
- .5 If human remains are discovered, notify immediately local police, the coroner's office, the Registrar of Cemeteries and the Departmental Representative.

1.34 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Management plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

1.35 NOISE

- .1 Noise protection in accordance with Section 01 11 00 - Summary of Work.
- .2 Minimize the noise levels from construction activities by using proper muffling devices, in addition to appropriate timing and location of

these activities to reduce or minimize the effect of noise on nearby residents, recreational users and wildlife.

.3 Comply with any local or municipal noise by-laws.

1.36 AQUATIC LIFE
PROTECTION

.1 Restricted in-water activities between March 15th and June 30th are in water excavation, in-filling, concrete/tremie pours, rock/armour stone placement, transfer/movement of granular material or aggregates.

.2 Amphibians, reptiles, fish, or crustaceans that could become or have become trapped within dewatered cofferdam area, or in other construction zones, to be captured and transferred "live" immediately by authorized personnel in accordance with permit conditions, to nearest body of water as directed by Departmental Representative.

.1 Work program to be overseen by Departmental Representative and PCA Environmental Authority to ensure proper capture and handling of aquatic life.

.2 Advise Departmental Representative and PCA Environmental Authority 24 hours prior to fish rescue.

.3 Minimize length of time fish are out of water.

.4 Use appropriate equipment when removing stranded fish.

.5 Monitor Work areas with deeper pool areas where fish is congregating, if safe to do so seine or dip nets can be operated to remove the fish.

.6 Document by species, counted and removed any fish found within dewatered areas, fish to be placed in nearest body of water.

.3 Should suspected species at risk be encountered during project staging, construction, or demobilization, contact Departmental Representative and PCA Environmental Authority immediately.

.4 Report to Departmental Representative and PCA Environmental Authority, invasive species found within project area.

.5 Invasive species to be euthanized rather than returned to water system.

.6 The intakes of pumping hoses will be equipped with an appropriate device to avoid entraining and impinging fish.

- .7 Retain the services of a qualified fish biologist who will be on-site during the de-watering process in order to rescue stranded fish (or other aquatic fauna).
- 1.37 SPECIES AT RISK
- .1 Provide training to all employees before beginning work on site on identifying species at risk and procedures to follow if species at risk are encountered.
- .2 Stop work and contact Departmental Representative and PCA Environmental Authority on how to proceed if species at risk does not or cannot leave site on its own accord.
- .3 Perform daily site sweeps before beginning work to ensure that there are no species at risk in work area.
- .4 Minimize disturbed areas and clearly mark Work space.
- .5 If species at risk are observed or encountered, the individual must not be harmed, harassed, or killed. Stand back and allow animal to leave site.
- .6 Surround stockpiled materials by sediment control fencing to prevent turtle nesting.
- 1.38 INVASIVE SPECIES
- .1 Clean mud, dirt, and vegetation off machinery and equipment before entering work site and before leaving work site. Inspect and clean in accordance with the EMP and Clean Equipment Protocol for Industry:
<https://www.ontarioinvasiveplants.ca/wpcontent/uploads/2016/07/Clean-Equipment-Protocol-June2016-D3-WEB-1.pdf>
- .2 Equipment and vehicles to be used in body of water, to be cleaned before and after use. This includes any visible mud, vegetation, mussels.
- .1 Drain of standing water.
- .2 Clean with hot water (>50°C) at high pressure (>250 psi).
- .3 Allow to dry for 2-7 days in sunlight before transporting between bodies of water.
- .4 Conduct cleaning minimum 30 m from edge of body of water.
- .3 Submit photo and report to Invading Species Hotline (1- 800-563-7711) or online at EDDMaps Ontario, <https://www.eddmaps.org/ontario/> and to Departmental Representative and PCA Environmental Authority if an invasive species is suspected.
-

- .4 Conduct site assessment for invasive plant infestations prior carrying out field activities.
 - .5 Round gobies and other invasive species found during dewatering activities shall be euthanized and not returned to the water system. This shall be reported to PCA.
 - .6 Use weed-free material for erosion control and stabilization ensuring that seed does not potentially contain invasive plants.
 - .7 Commercially purchased seeds should have a label that states following:
 - .1 Species.
 - .2 Purity: no less than 90%.
 - .3 Weed seed content: tag should state no invasive plants are present, only use certified weed-free seed.
 - .4 Germination of desired seed: germination should not be less than 50% for most species with exceptions for some shrubs and forbs.
 - .8 Move only contaminate-free materials to non-infested areas to prevent spread of invasive plants.
 - .9 Familiarize workers with invasive species potentially present within work site areas including but not limited to; European Buckthorn, Japanese knotweed, and zebra mussel.
 - .10 Properly dispose of any found invasive species to ensure no further propagation.
 - .11 Preventative and Control Measures, as identified in the Ontario Waterways (2017) document to be incorporated into the EMP and implemented by the Contractor.
- 1.39 CORRECTIVE ACTIONS FOR WATER
- .1 When water quality is not in compliance with the required water quality performance criteria limits, stop in-water work and adjust operations to minimize turbidity. Make no claims for delays or adjustment to operations resulting from water quality exceedances.
 - .2 Cessation of in-water work:
 - .1 In-water work will cease at the first indication of a significant oil sheen or distressed or dying fish in the vicinity of the work area.
Departmental Representative may direct Contractor to other areas of work within the project limits while issues are investigated.
-

1.40 CONCRETE
ACTIVITIES

- .1 Maintain isolation of all cast-in-place concrete from water for a minimum 48 hours if ambient air temperature is below 0°C or until significantly cured with Ph reaching neutral levels.
 - .2 Avoid concrete and grouting activities during or immediately after wet weather conditions.
 - .3 Ensure use of concrete, sealants, and other compounds in accordance with appropriate Product Technical Data Sheet.
 - .4 Ensure Work involving cement containing materials will not deposit, directly or indirectly sediments, debris, concrete, concrete fines, wash, or contact water into or about watercourse.
 - .5 Remove dust, debris, unused aggregate and concrete rubble generated as result of concrete work and dispose off-site ensuring materials does not enter waterway.
 - .6 Place concrete debris into watertight container daily, or more frequently as directed.
 - .7 Isolate all work from waterway.
 - .8 A CO2 regulator, tank and diffuser hose will be kept on site in the event of concrete spills. The system will be sized for concrete volumes used in Work area. This should be employed for tremie concrete pours.
 - .9 Use of neutralizing acids is not permitted.
 - .10 Direct concrete wash water to a collection and treat to effectively remove all suspended solids, dissipate velocity and prevent deleterious substances from entering waterway.
 - .11 In event of a release of concrete, notify Departmental Representative, PCA Environmental Authority and Ontario Ministry of Environment and Climate Change Spills Action Centre (Tel: 1-800-268-6060).
 - .1 Clean up and execute remediation immediately in accordance with provincial and federal regulatory requirements and accepted by PCA Environmental Authority.
 - .2 Install additional turbidity curtain or sediment barriers as necessary.
 - .3 Document remediation, testing, results to be submitted to Departmental Representative and PCA Environmental Authority.
 - .12 Maintain pH at discharge point into watercourse between 6.5 and 9.0.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFUELING
- .1 Refueling of equipment to be performed in locations as directed by Departmental Representative.
 - .2 Do not refuel equipment within 30 m of any watercourse or storm water catch basin unless protection against spills is in place and location is approved by Departmental Representative.
 - .3 Use petroleum containers approved for products with no spill fill spouts for dispensing fuels. The sure pour nozzle to have self closing valve, prevent any flow of fuel until the nozzle is inserted into the receiving container. On removal from the receiving container the slide valve closes to eliminate any fuel spill. Nozzle to be equipped with its own automatic vent eliminating the need for the user to open or close air inlets on the pouring container.
 - .4 Nozzle to support the weight of the pouring container. Nozzles to automatically stop the flow when the receiving container becomes full. The nozzle to be such that it reduces evaporative losses of volatile organic compounds during the fuel transfer.
 - .5 All spills of hydrocarbon based products such as gasoline, kerosene, naphtha, lubricating oils, engine oils, greases and de-icing fluids or antifreeze no matter how large or small shall be reported to the Spills Action Centre (SAC) Hotline should said spill have entered the waterway, or has potential to enter the waterway. Potential to enter the waterway shall be interpreted as a spill within direct proximity to the body of water, or has the potential to migrate/spread into the body of water via various means.
Spills Action Centre Hotline:
-1-416-325-3000 or 1-800-268-6060.
All spills shall be dealt with in accordance with Classification and Exemption of spills and reporting of discharges. Refer to the following link for additional information:
<https://www.ontario.ca/laws/regulation/980675>
 - .6 Oil changes or equipment repairs in the field or on Parks Canada land are not permitted.
 - .7 Refueling to be performed on level surfaces, PCC Portland cement concrete or HMAC surfaces when approved by the Departmental Representative unless otherwise directed.
 - .8 Contractor to have drip pans sized for amounts of product to be recovered and customized to fit under pieces of equipment to perform routine maintenance to

equipment while maintaining equipment on property.
Drip Pans to be used whenever leaving equipment on site or parking overnight when not in use.
Drip Pans are to be used for all fuel-run machinery and equipment present on site, regardless of whether in use or not.

- .9 Parking of equipment on site to be on level ground in locations away from watercourses and as approved by Departmental Representative.
- .10 Equipment with leaks or poor mechanical repair to be removed from site when so ordered by Departmental Representative.
- .11 No refueling to be conducted on Parks Canada Property.

1.2 SPILL CONTROL KIT

- .1 Contractor to have at the work site a spill control kit consisting of the following minimum types of equipment:
 - .1 A spaded shovel;
 - .2 A stable broom;
 - .3 A broad nosed shovel;
 - .4 A container(s) suitable, compatible to and of sufficient size to contain petroleum products being used with equipment;
 - .5 Absorbents;
 - .6 Rags;
 - .7 Metal container for soiled rags;
 - .8 Booms when working next to a watercourse that will traverse the width of the watercourse by two times; and
 - .9 Spill control kit to be inspected and approved by both the Ontario Ministry of the Environment and the Departmental Representative prior to Work commencing. Spill control kits to be available to Contractor employees at all areas where Work of the Contract is being performed and at all times during the course of the Contract.
 - ~~.10~~ Contractor employees to be trained in the use of the spill control kit and the equipment they contain.
 - .10

1.3 SPILLS

- .1 Disposal of spilled materials and impacted/contaminated material to be off Parks Canada property and at approved locations for materials to be disposed of.
- .2 When parking of equipment on site, the equipment is to be secured from entry, inspected for leaks and the ground protected from leaks.

Formatted: List Paragraph, Indent: Left: 0.01", Hanging: 0.39", Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"

- .3 Contractor to protect all wells, catch basins, drywells, drains and watercourses from contamination in event of a spill.
- .4 All equipment to be used for the Work of the Contract to be inspected by the Departmental Representative as the site is on Federal lands. Equipment not in good repair to be removed/repared when directed by Departmental Representative.
- .5 All spills of any size are to be reported immediately to Departmental Representative, the Park's Environmental Protection Officer (EPO) and the Ontario Ministry of the Environment and Climate Change Resources.
- .6 Contractor to immediately remove as much or all of the contaminated soils as possible, from any spills created from Work of the Contractor.
- .7 Contaminated soils/materials to be placed in containers compatible to the contaminants.
- .8 Any remaining clean-up to be performed at no extra cost to Parks Canada. Clean-up to be to the Departmental Representative's satisfaction.
- .9 Document remediation, testing and results to be submitted to Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY .1 This section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are: or become, in force during performance of Work.
- 1.2 RELATED SECTIONS .1 Section 02 41 13 - Selective Site Demolition
 .2 Section 02 41 13.13 - Paving Removal
 .3 Section 02 41 16 - Structure Demolition
 .4 Section 02 42 13 - Deconstruction of Structures
- 1.3 REFERENCES .1 Perform Work in accordance with:
 .1 2015 National Building Code of Canada (NBCC 2015).
 .2 Canadian Highway Bridge Design Code (CHBDC).
 .3 Occupational Health and Safety Act revised Statutes of Ontario 1990, Chapter 0.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended - updated 2016.
 .2 Amendments to any referenced standards up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
 .3 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code.
 .1 Meet or exceed requirements of:
 .1 Contract documents.
 .2 Specified standards, codes and referenced documents.
- 1.4 HISTORIC CANAL REGULATIONS .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.
- 1.5 QUALITY ASSURANCE .1 Regulatory Requirements: Except as otherwise specified, Contractor will apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 .1 Regulatory requirements and fees in force on date of Bid submission.
-

- .2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission.

PART 2 - PRODUCTS

2.1 EASEMENTS AND NOTICES

- .1 Owner will obtain permanent easements and rights of servitude that may be required for performance of Work.
- .2 Contractor will give notices required by regulatory requirements.
- .3 Owner will give notice to Contractor prior to visiting the site.

2.2 PERMITS

- .1 Development Permit: Owner has applied for, obtained, and paid for development permit.
- .2 Constructor will require that specific Subcontractor's obtain and pay for permits required by authorities having jurisdiction, where their Work is affected by Work requiring permits.
- .3 Constructor will display building permit and other permits in a conspicuous location at Place of Work. The Environmental Management Plan and Basic Impact Analysis shall also be displayed.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 03 30 00 - Cast-In-Place Concrete.
 - .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .3 Section 32 11 16.01 - Granular Sub-Base.
 - .4 Section 32 11 23 - Aggregate Base Courses.
 - .5 Section 32 12 16.01 - Asphalt Paving.
- 1.2 SECTION INCLUDES
- .1 Inspection and testing, administrative and enforcement requirements.
 - .2 Tests and mix designs.
 - .3 Test assembly.
 - .4 Mill tests.
 - .5 Equipment and system adjust and balance.
- 1.3 CONTRACTOR RESPONSIBILITY
- .1 Departmental Representative's Quality Control methods shall not relieve the contractor from their responsibility for Quality Assurance, including but not limited to: procedures, controls internal and independent testing.
- 1.4 INSPECTION
- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
 - .2 Provide 48 hour notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions.
 - .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
 - .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.
-

-
- 1.5 INDEPENDENT INSPECTION AGENCIES
- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.
- 1.6 ACCESS TO WORK
- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
 - .2 Co-operate to provide reasonable facilities for such access.
- 1.7 PROCEDURES
- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
 - .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- 1.8 REJECTED WORK
- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
 - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
 - .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract
-

Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

- 1.9 REPORTS
- .1 Submit 1 digital (PDF) copy or 4 copies of inspection and test reports to Departmental Representative.
 - .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.
- 1.10 TESTS AND MIX DESIGNS
- .1 The Departmental Representative reserves the option to have testing completed (at their cost) over and above the minimum required by law.
 - .2 Furnish test results and mix designs may be requested.
- 1.11 TEST ASSEMBLY
- .1 Construct in all locations acceptable to Departmental Representative.
 - .2 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.
 - .3 Test assembly of new span off site to test approximate span balance prior to delivery to site.
- 1.12 MILL TESTS
- .1 Submit mill test certificates to Departmental Representative for review and approval prior to commencement of fabrication.
- 1.13 EQUIPMENT AND SYSTEMS
- .1 Submit testing, adjusting and balancing reports for mechanical, electrical systems that is signed and sealed by a Professional Engineer licensed or registered in the Province of Ontario.
 - .2 Submit Commissioning Documentation in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 03 30 00 - Cast-in-Place Concrete.
 - 1.2 SECTION INCLUDES .1 Temporary Utilities.
 - 1.3 REFERENCES .1 Canadian Environmental Protection Act, 1999.
.2 U.S. Environmental Protection Agency (EPA) / Office of Water:
 - .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.
 - 1.4 SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - 1.5 INSTALLATION AND REMOVAL .1 Provide temporary utilities controls in order to execute work expeditiously.
.2 Remove from site all such work after use or as directed by Departmental Representative.
 - 1.6 DEWATERING .1 Dewatering Plan to be provided as a component of the Environmental Management Plan.
.2 Provide temporary drainage to keep excavations and site free from standing water.
.3 Ensure discharge is not contaminated with sediment, oil, etc.
.4 The canal is naturally dewatered in the Fall, any further dewatering of the canal required to complete the work shall be only with approval of the Departmental Representative.
 - 1.7 WATER SUPPLY .1 Provide continuous supply of potable water for construction use.
.2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
.3 Pay for utility charges at prevailing rates.
 - 1.8 TEMPORARY POWER AND LIGHT .1 Departmental Representative will not provide or pay for temporary power during construction for temporary lighting and operating of power tools.
-

- .2 Arrange for connection with appropriate utility company. Pay all costs for supply, installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project.
- .5 Coordinate with Departmental Representative.
- .6 Supply and install temporary facilities for power to approval of local power supply authorities.
- .7 Provide and pay for temporary power and lights for use of Departmental Representative site office.

1.9 TEMPORARY HEATING
AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance, fuel, and suitable enclosures as necessary.
- .2 Construction heaters used inside buildings must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work

process to assure removal of harmful
contaminants.

- .5 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
 - .6 Hoard, heat and provide protection for curing concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.
- 1.10 TEMPORARY COMMUNICATION FACILITIES
- .1 Provide and pay for temporary telephone, fax and data hook up, line(s) and equipment as necessary for own use.
- 1.11 FIRE PROTECTION
- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
 - .2 Burning rubbish and construction waste materials is not permitted on site.
- 1.12 SANITARY FACILITIES
- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
 - .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
 - .3 All surface modifications are restricted to the identified corridors. Accurate delineation of these corridors by field survey is required prior to commencement of construction.
- 1.13 STORAGE SHEDS
- .1 Provide adequate weather-tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.
- 1.14 ACCESS
- .1 Provide and maintain adequate access to project site.
 - .2 Build and maintain temporary roads where indicated and provide snow removal during period of work.

- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 All surface modifications are restricted to the identified construction corridors.
- .5 Accurate delineation of these corridors by field survey prior to commencement of construction is required.
- .6 All vehicle traffic is restricted to existing roadways or as indicated in project plans. A field visit will be scheduled with the Contractor for location confirmation and all areas of proposed construction will be marked in the field with orange flagging tape prior to commencement of work.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings and sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Construction aids.
 - .2 Office and sheds.
 - .3 Parking.
 - .4 Project identification.
- 1.2 REFERENCES
- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 Canadian Standards Association (CSA International):
 - .1 CSA A23.1-09/A23.2-09 (R2014), Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.
 - .2 CSA 0121-08, Douglas Fir Plywood.
 - .3 CSA Z797-09, Code of practice for Access Scaffold.
 - .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.
 - .3 Canadian Environmental Protection Act, 1999.
 - .4 U.S. Environmental Protection Agency (EPA) /Office of Water:
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.3 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 INSTALLATION AND REMOVAL
- .1 Provide construction facilities in order to execute work expeditiously.
 - .2 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
 - .3 Gravel areas to prevent tracking of mud. Identify areas that require gravelling.
 - .4 Indicate use of supplemental or other staging area.
 - .5 Remove from site all such work after use.
-

- 1.5 SCAFFOLDING
- .1 Provide and maintain scaffolding, ladders and temporary stairs.
 - .2 Scaffolding in accordance with CAN/CSA Z797.
- 1.6 HOISTING
- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
 - .2 Hoists/cranes shall be operated by qualified operator.
- 1.7 SITE STORAGE /
LOADING
- .1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.
 - .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- 1.8 CONSTRUCTION
PARKING
- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
 - .2 Provide marked and fully stocked first-aid case in a readily available location.
 - .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
 - .4 Departmental Representative's Site Office.
 - .1 Provide separate temporary office trailer for Departmental Representative.
 - .2 Trailer to be minimum 6.1 m in length, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.
 - .3 Trailer to be insulated and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .5 Install electrical lighting system to provide min. 750 lx using surface mounted, shielded commercial fixtures with 10% upward light components.
 - .6 Provide telephone and fax machine and communications hook-up for telephone, fax and internet. Capacity of internet to be suitable for business applications. Hardware and all communication connections to be maintained throughout the project.
-

- .7 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory, mirror and hand wash facility (chemical or portable water and soap) and maintain supply of paper towels and toilet tissue.
 - .8 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
 - .9 Equip office with water cooler / filter and maintain supply of bottled water.
 - .10 Maintain in clean condition.
 - .11 If site office cannot provide telephone and internet connection, a second office within 3 km of the site is to be provided which conforms to all conditions including telephone and internet connection.
- 1.9 SECURITY
- .1 Contractor shall provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays, if applicable.
- 1.10 OFFICES
- .1 Provide for use of Departmental Representative a desk in Contractors office trailer if requested.
 - .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
 - .3 Contractors and Subcontractors may provide their own offices as necessary. Location of these offices to be to the satisfaction of the Departmental Representative.
 - .4 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
 - .5 Maintain in clean condition.
- 1.11 EQUIPMENT TOOL AND MATERIALS STORAGE
- .1 Provide and maintain in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
 - .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.
- 1.12 SANITARY FACILITIES
- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
-

- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- 1.13 CONSTRUCTION SIGNAGE
- .1 No other signs or advertisements, other than warning signs, are permitted on site.
 - .2 Provide two project identification site signs comprising foundation, framing, and one 1200 x 2400 mm signboard as detailed and as described below.
 - .1 Foundations: 15 MPa concrete to CAN/CSA-A23.1/A23.2 minimum 200 mm x 900 mm deep.
 - .2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.
 - .3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA O121.
 - .4 Paint: alkyd enamel to CAN/CGSB-1.59 over exterior alkyd primer to CGSB 1-GP-189.
 - .5 Fasteners: hot-dip galvanized steel nails and carriage bolts.
 - .6 Vinyl sign face: printed project identification, self-adhesive, vinyl film overlay, supplied by Departmental Representative.
 - .3 Locate project identification sign as directed by Departmental Representative and construct as follows:
 - .1 Build concrete foundation, erect framework, and attach signboard to framing.
 - .2 Paint all surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.
 - .3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.
 - .4 Direct requests for approval to erect a Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording shall be in both official languages.
 - .5 Signs and notices for safety and instruction shall be in both official languages and approved by Departmental Representative. Graphic symbols shall conform to CAN/CSA-Z321.
 - .6 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.
-

1.14 PROTECTION AND
MAINTENANCE OF
TRAFFIC

- .1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .2 Provide access and temporary relocated roads and detours as necessary to maintain traffic.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads, access routes and allowable load limit on these roads, access routes, and any structures which may be loaded by construction loads. Contractor: responsible for repair of damage to roads, access routes, and associated structures caused by construction operations.
- .7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .8 Dust control: adequate to ensure safe operation at all times.
- .9 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .10 Provide snow removal during period of work.

1.15 CLEAN-UP

- .1 Clean continuously as work progresses.
 - .2 Remove construction debris, waste materials, packaging material from work site daily.
 - .3 Clean dirt or mud tracked onto paved or surfaced roadways.
 - .4 Store materials resulting from demolition activities that are salvageable.
 - .5 Stack stored new or salvaged material not in construction facilities.
-

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Barriers.
.2 Environmental Controls.
.3 Traffic Controls.
.4 Fire Routes.
- 1.2 REFERENCES .1 Ministry of Transportation, Ontario (MTO)
.1 Ontario Traffic Manual, Book 7: Temporary
Conditions - 2014.
.2 Manual for Uniform Traffic Control Devices
(UTCD) for Streets and Highways - 2014.
.2 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer
for Wood.
.2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss
Enamel.
.3 Canadian Standards Association (CSA
International):
.1 CSA-O121-08, Douglas Fir Plywood.
- 1.3 INSTALLATION AND .1 Provide temporary controls in order to execute
REMOVAL work expeditiously.
.2 Remove from site all such work after use.
- 1.4 HOARDING .1 Provide barriers around trees and plants
designated to remain. Protect from damage by
equipment and construction procedures.
.2 Erect temporary site enclosures using modular
freestanding fencing: galvanized, minimum 1.8 m
high, chain link or welded steel mesh, pipe rail.
Provide two lockable truck entrance gates and at
least one pedestrian door as directed and
conforming to applicable traffic restrictions on
adjacent streets. Equip gates with locks and keys.
Maintain fence in good repair.
.3 Protect trees and plants designated to remain from
damage by equipment and construction procedures.
-

-
- | | | |
|---|----|---|
| 1.5 GUARD RAILS AND BARRICADES | .1 | Provide secure, rigid guard rails and barricades around deep excavations. |
| | .2 | Provide as required by governing authorities. |
| 1.6 ACCESS TO SITE | .1 | Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, hoarding and temporary lighting as required. |
| | .2 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. |
| | .3 | Remove from site all such work after use. |
| 1.7 PUBLIC TRAFFIC FLOW | .1 | Provide concrete jersey barriers along edge of excavation and embankment. |
| | .2 | Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public. |
| 1.8 FIRE ROUTES | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles. |
| 1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY | .1 | Protect surrounding private and public property from damage during performance of Work. |
| | .2 | Be responsible for damage incurred. |
| 1.10 PROTECTION OF BRIDGE FINISHES | .1 | Provide protection for finished and partially finished bridge finishes and equipment during performance of Work. |
| | .2 | Provide necessary screens, covers, and hoardings. |
| | .3 | Confirm with Departmental Representative locations and installation schedule 3 days prior to installation. |
| | .4 | Be responsible for damage incurred due to lack of or improper protection. |
| 1.11 WASTE MANAGEMENT AND DISPOSAL | .1 | Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal. |
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.
- .4 Existing facilities.
- 1.2 REFERENCES .1 Within text of specifications, reference may be made to reference standards.
- .2 Conform to these standards, in whole or in part as specifically requested in specifications.
- .3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .4 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .6 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at <http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>.
- 1.3 QUALITY .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
-

- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout bridge.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.
- .3 If only 1 product is approved and listed in a specification section but is no longer available, a proposed alternate must meet all the criteria of the specified product and be approved by Departmental Representative.

1.5 METRIC SIZED MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
- .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.6 STORAGE,
HANDLING AND
PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

- 1.7 TRANSPORTATION .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.
- 1.8 MANUFACTURER'S INSTRUCTIONS .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- 1.9 QUALITY OF WORK .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.
- 1.10 COORDINATION .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of interfacing components and accessories.
-

- 1.11 CONCEALMENT
- .1 In finished areas, conceal pipes, ducts and wiring, except where indicated otherwise.
 - .2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
- 1.12 REMEDIAL WORK
- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
 - .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.
- 1.13 LOCATION OF FIXTURES
- .1 Consider location of fixtures, and mechanical and electrical items indicated as approximate.
 - .2 Inform Departmental Representative of conflicting installation. Install as directed.
- 1.14 FASTENINGS
- .1 All fastenings to be in accordance with Contract Documents.
 - .2 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
 - .3 Prevent electrolytic action between dissimilar metals and materials.
 - .4 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
 - .5 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
 - .6 Keep exposed fastenings to a minimum, space evenly and install neatly.
 - .7 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- 1.15 FASTENINGS - EQUIPMENT
- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
-

- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No.304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF
WORK IN PROGRESS

- .1 Prevent overloading of any part of the bridge. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.17 EXISTING
UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Field engineering survey services to measure and stake site.
 - .2 Survey services to establish and confirm elevations for Work.
 - .3 Recording of subsurface conditions found.
- 1.2 REFERENCES
- .1 Owner's identification of existing survey control points and property limits.
- 1.3 QUALIFICATIONS OF SURVEYOR
- .1 Qualified registered land surveyor, licensed to practice in Province of Ontario, acceptable to Departmental Representative.
- 1.4 SURVEY REFERENCE POINTS
- .1 Existing base horizontal and vertical control points are to be established with legal survey.
 - .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
 - .3 Make no changes or relocations without prior written notice to Departmental Representative.
 - .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - .5 Require surveyor to replace control points in accordance with original survey control.
- 1.5 SURVEY REQUIREMENTS
- .1 Establish two permanent bench marks on site, referenced to established Ontario geodetic control database bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
 - .2 Establish lines and levels, locate and lay out, by instrumentation.
 - .3 Stake for grading, fill and topsoil placement.
 - .4 Stake slopes.
 - .5 Establish pipe invert elevations and location of any exposed pipe not being removed under this contract.
 - .6 Record elevation and location of all existing and installed end caps of abandoned underground services.
-

.7 Establish lines and levels for mechanical and electrical work.

1.6 EXISTING SERVICES .1 Before commencing work, conduct a full topographic survey of the bridge and area of Work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

.2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.7 LOCATION OF EQUIPMENT AND FIXTURES .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.8 RECORDS .1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.9 SUBMITTALS .1 Submit name and address of Surveyor to Departmental Representative.

- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conforms with Contract Documents.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUBMITTALS
- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit written request in advance of cutting or alteration which may affect:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
 - .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.
- 1.2 MATERIALS
- .1 Required for original installation.
 - .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3 PREPARATION
- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of Work.
 - .3 Beginning of cutting or patching means acceptance of existing conditions.
 - .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
 - .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.
- 1.4 EXECUTION
- .1 Execute cutting, fitting, and patching including excavation and fill to complete Work.
-

- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

1.5 WASTE MANAGEMENT
AND DISPOSAL

- .1 Separate waste materials for reuse, recycling, composting, and anaerobic digestion in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Progressive cleaning.
.2 Final cleaning.
- 1.2 PROJECT CLEANLINESS .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
.3 Clear snow and ice from site, including on bridges, sidewalks, and Parks Canada parking lot (existing and new) and remove from site. Accumulated snow and ice should not be deposited in the waterbody or stockpiled in a location where it is feasible for melt and surface runoff from the stockpile to migrate into the waterbody. Stockpiles of ice and snow are to be appropriately isolated.
.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
.5 Provide on-site containers for collection of waste materials and debris.
.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
.7 Remove waste material and debris from site at end of each working day.
.8 Dispose of waste materials and debris off site.
.9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- 1.4 FINAL CLEANING .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
-

- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Sweep and wash clean paved areas.
- .11 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .12 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .13 Remove snow and ice from access to bridge, sidewalks and Parks Canada parking lot.

1.5 WASTE MANAGEMENT
AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 02 41 13 - Selective Site Demolition.
 - .2 Section 02 41 13.13 - Paving Removal.
 - .3 Section 02 41 16 - Structure Demolition.
 - .4 Section 02 83 10 - Lead-Based Paint Abatement: Minimum Precautions.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM E 1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program.
 - .2 Recycling Certification Institute (RCI):
 - .1 RCI Certification Construction and Demolition Materials Recycling.
- 1.3 SUMMARY
- .1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill.
 - .2 Preparation of a Draft Waste Reduction Workplan that will be used to track the success of the Waste Reduction Workplan against actual waste diversion from landfill.
 - .3 Preparation of a Waste Reduction Workplan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.
 - .4 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.
 - .5 Preparation of a Waste Reduction Workplan Report containing detailed information indicating total waste produced by the project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.
 - .6 Owner has established that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.
-

1.4 DEFINITIONS

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, repair and demolition operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.
- .4 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .5 Non hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .6 Non toxic: Not poisonous to humans either immediately or after a long period of exposure.
- .7 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .8 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .11 Return: To give back reusable items or unused products to vendors for credit.
- .12 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modeling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.Returning reusable items including pallets or unused products to vendors.
- .13 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

- .14 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.
- .15 Separate Condition: Refers to waste sorted into individual types.
- .16 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .17 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .18 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .19 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings;
 - .2 Wood preservatives; strippers and household cleaners;
 - .3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.
 - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .20 Waste: Extra material or material that has (Cont'd) reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .21 Waste Reduction Workplan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.5 ADMINISTRATIVE
REQUIREMENTS

- .1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project and ensure that requirements of the Waste Reduction Workplan are followed.
- .2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 - Project Meetings before starting any Work of the Contract attended by the Owner, Contractor, affected Subcontractor's and Departmental Representative to discuss the Contractor's Waste Reduction Workplan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

- 1.6 CONSTRUCTION AND DEMOLITION WASTES
- .1 Carefully deconstruct and source separate materials/equipment and divert, from C&D waste destined for landfill to maximum extent possible. Target for this project is 75% diversion from landfill. Reuse, recycle or sell material for reuse except where indicated otherwise. On site sales are not permitted.
 - .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and Portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Steel.
 - .5 Lead paint on steel.
 - .6 Items indicated in Section 02 41 13 - Selective Site Demolition and Section 02 41 16 - Structure Demolition.
 - .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested using Section 02 41 13 - Selective Site Demolition.
 - .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.
 - .5 The Contractor shall develop all means and methods necessary to accomplish the removals, transportation and disposal to a suitable site of any impacted elements, including recognition of any and all regulatory requirements respecting hazardous materials. This may include but not be limited to:
 - .1 Lead-based coatings.
 - .6 The Contractor is to include in the price for the Work all necessary requirements as identified above
- 1.7 DOCUMENTS
- .1 Maintain at job site, one copy of the Material Source Separation Plan.
-

-
- 1.8 SUBMITTALS
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Waste Reduction Workplan (WRW): Submit a WRW for this project prior to any waste removal from site and that includes the following information:
 - .1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the WRW; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.
 - .2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into WRW.
 - .3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the project, and the proposed local market for each material.
 - .4 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.
 - .5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the project.
 - .6 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
 - .7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.
-

- 1.9 PROJECT CLOSEOUT SUBMISSIONS .1 Diversion Documentation: Submit as constructed information in accordance with Section 01 78 00 - Closeout Submittals as follows:
- .1 Waste Reduction Workplan Report (WRW Report): Submit a WRW Report for this project in a format acceptable to submittal requirements and that includes the following information:
 - .1 Accounting: Submit information indicating total waste produced by the project.
 - .2 Composition: Submit information indicating types of waste material and quantity of each material.
 - .3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the project.
 - .4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.
 - .5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the project.
 - .6 Multiple Waste Hauling: Compile all information into a single WRW Report where multiple waste hauling and diversion strategies were used for the project.
 - .7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.
- 1.10 QUALITY ASSURANCE .1 Resources for Development of Waste Reduction Workplan Report (WRW Report): The following sources may be useful in developing the Draft Waste Reduction Workplan:
- .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into WRW.
 - .2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.
- .2 Certifications: Provide proof of the following during the course of the Work:
- .1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the
-

registration and certification requirements of the Recycling Certification Institute.

- 1.11 WASTE PROCESSING SITES .1 Province of Ontario:
- .1 Name: Ontario Ministry of Environment, St. Clair Avenue West, Toronto, On M4V 1P5.
 - .2 Telephone: 1-800-565-4923 or 1-416-323-4321.
 - .3 Fax: 1-416-323-4682
- .2 Recycling Council of Ontario: 51 Wolseley Street, 2nd Floor, Toronto, ON, M5T 1A4.
- .1 Telephone: 1-416-657-2797.
 - .2 Fax: 1-416-960-8053
 - .3 Email: rco@rco.on.ca.
 - .4 Internet: <http://www.rco.on.ca/>.
- 1.12 WASTE REDUCTION WORKPLAN (WRW) .1 Prepare Waste Reduction Workplan.
- .2 Structure WRW to prioritize actions and follow as first priority Reuse, then followed by Recycle.
 - .3 Describe management of waste.
 - .4 Post workplan or summary where workers at site are able to review its content.
- 1.13 MATERIALS SOURCE SEPARATION PROGRAM (MSSP) .1 Prepare MSSP and have ready for use prior to project start-up. The DWA with related weight bills and/or receipt must be submitted on a monthly basis with the Contractor's monthly Progress claim.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
 - .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
 - .4 Provide containers to deposit reusable and recyclable materials.
 - .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
 - .6 Locate separated materials in areas which minimize material damage.
 - .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- 1.14 DELIVERY, STORAGE AND HANDLING .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
-

- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of work area is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide weigh-bills for separated materials.

1.15 DISPOSAL OF
WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.16 USE OF SITE AND
FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by Parks Canada.

- 1.17 SCHEDULING .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 WRW IMPLEMENTATION .1 Manager: Contractor is responsible for designating an on-site party or parties responsible for instructing workers and overseeing and documenting results of the WRW for the project.
- .2 Distribution: Distribute copies of the WRW to the job site foreman, each Subcontractor, the Owner, the Departmental Representative and other site personnel as required to maintain WRW.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the project to Subcontractor's at appropriate stages of the project.
- .4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:
- .1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
- .2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.
- .5 Progressive Documentation: Submit a monthly summary of waste generated by the project to ensure that waste diversion goals are on track with project requirements:
- .1 Submission of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Owner, Contractor and Departmental Representative.
- .2 Monthly waste summary shall contain the following information:
- .1 The amount in tonnes or m³ and location of material landfilled.
- .2 The amount in tonnes or m³ and location of materials diverted from landfill.
- .3 Indication of progress based on total waste generated by the project with materials diverted from landfill as a percentage.

- 3.2 SUBCONTRACTOR'S RESPONSIBILITY .1 Subcontractor's shall cooperate fully with the Contractor to implement the WRW.
- .2 Failure to cooperate may result in the Owner not achieving their environmental goals, and may result in penalties being assessed by the Contractor to the responsible Subcontractor's.
- 3.3 CLEANING .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.
- 3.4 DIVERSION OF MATERIALS .1 On-site sale of salvaged, recovered, reusable and recyclable materials is not permitted.
- 3.5 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT .1 Schedule E - Government Chief Responsibility for the Environment:
- | Province | Address | General Inquiries | Fax |
|----------|---|----------------------------------|----------------|
| Ontario | Ministry of Environment and Energy
135 St Clair Avenue West
Toronto, ON
M4V 1P5 | 1-416-323-4321
1-800-565-4923 | 1-416-323-4682 |
| | Environment Canada
Toronto, ON | 1-416-734-4494 | |
- 3.6 CONSTRUCTION & DEMOLITION WASTE .1 Carefully deconstruct and source separate materials/equipment and divert from C&D waste destined for landfill to maximum extent possible. Reuse, recycle or sell material off site for reuse except where indicated otherwise. On site sales are not permitted.
- .2 For construction and demolition projects source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
- .1 Provide facilities for collection, handling and storage of source separated wastes.
- .2 Source separate the following waste:
- .1 Brick and Portland cement concrete.
- .2 Corrugated cardboard.
- .3 Wood, not including painted or treated wood or laminated wood.

- .4 Gypsum board, unpainted.
- .5 Steel. Section 01 35 43 -
 Archaeological, Cultural and
 Environmental Procedures and Section 02
 41 13 - Selective Site Demolition. These
 sections have detailed lists of
 materials to be recycled.
- .3 Submit a Waste Reduction Workplan (WRW) indicating
 the materials and quantities of material that will
 be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the
 site will be reused or recycled.
- .4 Submit proof that all waste is being disposed of at
 a licensed land fill site or waste transfer site. A
 copy of the disposal/waste transfer site's license
 and a letter verifying that said landfill site will
 accept the waste must be supplied to Departmental
 Representative prior to removal of waste from the
 demolition site.
- .5 Remove all surplus materials from the site at
 completion of work.

3.7 SAMPLE WASTE
 REDUCTION FORM

- .1 Sample waste tracking form below can be used by the
 Contractor to establish their own forms for
 recording management of construction waste:
 SAMPLE WASTE REDUCTION FORM.

Material Streams Contributing to Credit:

Material	Sept	Oct	Nov	Dec	Total	Units
Clean Wood	0	25	0	1.25	26.25	m ³
Metal	1.25	2.5	5.5	7	16.25	m ³
Concrete	10.5	2.5	5.5	8.75	27.25	m ³
Asphalt	10	0	0	0	10	m ³
Total Diverted Waste					79.75	m ³

Material Streams NOT Contributing to Credit:

Material	Sept	Oct	Nov	Dec	Total	Units
Landfill	10.7	7.5	15	10	43.2	m ³
Screen Fines (ADC)	5	1.25	0	2.5	8.75	m ³
150 mm minus ADC	1.25	1.25	5	5.5	13	m ³
Total Diverted Waste					64.95	m ³

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Environmental Protection Act (CEPA):
.1 SOR/2008-197, Storage Tank Systems for
Petroleum Products and Allied Petroleum
Products Regulations.
- 1.2 ADMINISTRATIVE .1 Acceptance of Work Procedures:
REQUIREMENTS .1 Contractor's Inspection: Contractor: conduct
inspection of Work, identify deficiencies and
defects, and repair as required to conform to
Contract Documents.
.1 Notify Departmental Representative in
writing of satisfactory completion of
Contractor's inspection and submit
verification that corrections have been
made.
.2 Request Departmental Representative
inspection.
.2 Departmental Representative Inspection:
.1 Departmental Representative and
Contractor to inspect Work and identify
defects and deficiencies.
.2 Contractor to correct Work as directed.
.3 Completion Tasks: submit written
certificates that tasks have been performed
as follows:
.1 Work: completed and inspected for
compliance with Contract Documents.
.2 Defects: corrected and deficiencies
completed.
.3 Equipment and systems: tested, adjusted
and balanced and fully operational.
.4 Operation of systems: demonstrated to
Owner's personnel.
.5 Commissioning of mechanical systems:
completed in accordance with Section 01
91 13 - General Commissioning (Cx)
Requirements and 2 and copies of final
Commissioning Report submitted to
Departmental Representative.
.4 Final Inspection:
.1 When completion tasks are done, request
final inspection of Work by
Departmental Representative, and
Contractor.
.2 When Work incomplete according to Owner
and Departmental Representative,
complete outstanding items and request
re-inspection.
.5 Declaration of Substantial Performance: when
Departmental Representative considers
deficiencies and defects corrected and
requirements of Contract substantially
performed, make application for Certificate
of Substantial Performance.

1.4 INSPECTION AND
DECLARATION

- .6 Commencement of Lien and Warranty Periods:
date of Owner's acceptance of submitted
declaration of Substantial Performance to be
date for commencement for warranty period
and commencement of lien period unless
required otherwise by lien statute of Place
of Work.
- .1 Contractor's Inspection: Contractor and all
Subcontractors shall conduct an inspection of
Work, identify deficiencies and defects, and
repair as required to conform to Contract
Documents
 - .1 Notify Departmental Representative in writing
of satisfactory completion of Contractor's
Inspection and submit verification that
corrections have been made.
 - .2 Request Departmental Representative's
Inspection.
- .2 Departmental Representative's Inspection:
Departmental Representative and Contractor will
perform inspection of Work to identify obvious
defects or deficiencies. Correct Work accordingly.
- .3 Completion: submit written certificate that tasks
have been performed as follows:
 - .1 Work has been completed and inspected for
compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies
have been completed.
 - .3 Equipment and systems have been tested,
adjusted, balanced and are fully
operational.
 - .4 Certificates required by Utility companies
have been submitted.
 - .5 Commissioning of the bridge has been
completed in accordance with 01 91 13 -
General Commissioning (Cx) Requirements.
 - .6 Operation of all systems have been
demonstrated to Departmental Representative
and reviewed operating manuals have been
provided to the Departmental Representative.
 - .7 Work is complete and ready for final
inspection.
 - .8 Closeout submittals have been provided in
accordance with Section 01 78 00 - Closeout
Submittals.
- .4 Final Inspection: when items noted above are
completed, request final inspection of Work by
Departmental Representative and Contractor. If
Work is deemed incomplete by Departmental
Representative, complete outstanding items and
request re-inspection.

PART 1 - GENERAL

- 1.2 SECTION INCLUDES
- .1 As-built, samples, and specifications.
 - .2 Equipment and systems.
 - .3 Product data, materials and finishes, paint colour mixes and related information.
 - .4 Operation and maintenance data.
 - .5 Spare parts, special tools and maintenance materials.
 - .6 Warranties and bonds.
 - .7 Final site survey.
- 1.3 SUBMITTALS
- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Copy will be returned after final inspection with Departmental Representative's comments.
 - .3 Revise content of documents as required prior to final submittal.
 - .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.
 - .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
 - .6 If requested, furnish evidence as to type, source and quality of products provided.
 - .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
 - .8 Pay costs of transportation.
- 1.4 FORMAT
- .1 Organize data in the form of an instructional manual.
 - .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
 - .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of
-

project and identify subject matter of contents.

- .5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format. Forward pdf and Autocad dwg files on USB or CD in accordance with PWGSC CAD Standards.

1.5 CONTENTS -
PROJECT RECORD
DOCUMENTS

- .1 Table of Contents:
 - .1 Title of project;
 - .2 Date of submission; names,
 - .3 Addresses, and telephone numbers of Contractor with name of responsible parties;
 - .4 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 AS-BUILTS
DOCUMENTS AND
SAMPLES

- .1 Maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Change Orders and other modifications to the Contract.

- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.7 RECORDING
INFORMATION ON
PROJECT RECORD
DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.

- .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
-
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Amendments and change orders.
 - .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
 - .7 Provide digital photos, if requested, for site records.
-
- 1.8 FINAL SURVEY
- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
-
- 1.9 EQUIPMENT AND SYSTEMS
- .1 For each item of equipment and each system: include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics, and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
 - .3 Include installed colour coded wiring diagrams.
 - .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
 - .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - .6 Provide servicing and lubrication schedule, and list of lubricants required.
-

- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
- .15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Applied Materials and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include
-

approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 MAINTENANCE
MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

- .2 Provide items of same manufacture and quality as items in Work.

- .3 Deliver to location as directed; place and store.

- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.

- .6 Extra Stock Materials:

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

- .2 Provide items of same manufacture and quality as items in Work.

- .3 Deliver to site; place and store.

- .4 Receive and catalogue items.

- .1 Submit inventory listing to Departmental Representative.

- .2 Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.

- .2 Provide items with tags identifying their associated function and equipment.

- .3 Deliver to location as directed; place and store.

- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.14 DELIVERY,
STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.

- .3 Store components subject to damage from weather in weatherproof enclosures.

- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.15 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten] days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers

- involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include pumps, motors, and commissioned systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
 - .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
 - .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.
 - 1.18 WARRANTY TAGS
 - .1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Departmental Representative.
 - .2 Attach tags with copper wire and spray with waterproof silicone coating.
 - .3 Leave date of acceptance until project is accepted for occupancy.
-

- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 26 05 00 - Common Works Results For Electrical.
- .2 Section 26 24 19 - Motor Control Centers.
- .3 Section 26 24 21 - Operator Control Stations.
- .4 Section 26 56 20 - Navigation Lights.
- .5 Section 26 56 21 - Traffic Gates.
- .6 Section 29 05 00 - Mechanical Work - General.
- 1.2 SECTION INCLUDES .1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.
- .2 O&M personnel includes property facility manager, building operators, maintenance staff, security staff and technical specialists, as applicable.
- 1.3 DESCRIPTION .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
- .2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
- 1.4 QUALITY CONTROL .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
- .1 Instruct Owner's personnel.
- .2 Provide written report that demonstration and instructions have been completed.
- .2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Report shall give time and date of each demonstration and training, with list of persons present.
- 1.5 CONDITIONS FOR DEMONSTRATIONS .1 Equipment has been inspected and put into operation in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
-

- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
 - .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

 - 1.6 PREPARATION
 - .1 Verify that conditions for demonstration and instructions comply with requirements.
 - .2 Verify that designated O&M personnel are present.

 - 1.7 DEMONSTRATION AND INSTRUCTIONS
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times and at the equipment location.
 - .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
 - .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.
 - .5 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.

 - 1.8 TIME ALLOCATED FOR INSTRUCTIONS
 - .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 TBD.

 - 1.9 SUBMITTALS
 - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit schedule of time and date for demonstration of each item of equipment and each system [two weeks] prior to designated dates, for Departmental Representative's approval.
 - .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
 - .4 Give time and date of each demonstration, with list of persons present.
-

- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 O&M - Operation and Maintenance Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the O&M.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to function as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING
OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.

- .3 Cx to be a line item of Contractor's cost breakdown.
 - .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
 - .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
 - .6 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.
- 1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS
- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
 - .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.
- 1.05 PRE-CX REVIEW
- .1 Before Construction:
 - .1 Review Contract Documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
 - .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
 - .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
-

- .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.
- 1.6 CONFLICTS
- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
 - .2 Failure to report conflict and obtain clarification will result in application of the most stringent requirement.
- 1.7 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than [4] weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least [8] weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least [8] weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative.
- 1.8 COMMISSIONING DOCUMENTATION
- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
 - .2 Departmental Representative to review and approve Cx documentation.
 - .3 Provide completed and approved Cx documentation to
-

Departmental Representative.

1.9 COMMISSIONING
SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING
MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings, and as required.

1.11 STARTING AND
TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

-
- 1.12 WITNESSING OF STARTING AND TESTING
- .1 Provide [14] days notice prior to commencement.
 - .2 Departmental Representative to witness start-up and testing.
 - .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.
- 1.13 MANUFACTURER'S INVOLVEMENT
- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
 - .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
 - .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
 - .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.
- 1.14 PROCEDURES
- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
 - .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
-

- .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
 - .4 Document require tests on approved PV forms.
 - .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.
- 1.15 START-UP DOCUMENTATION
- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
 - .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.
-

-
- 1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS
- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
 - .2 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval before implementation.
 - .3 Operate and maintain systems for length of time required for commissioning to be completed.
 - .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.
- 1.17 TEST RESULTS
- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
 - .2 Provide manpower and materials, assume costs for re-commissioning.
- 1.18 START OF COMMISSIONING
- .1 Notify Departmental Representative at least [21] days prior to start of Cx.
 - .2 Start Cx after elements of facility affecting start-up and performance verification of systems have been completed.
- 1.19 INSTRUMENTS / EQUIPMENT
- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
 - .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.
- 1.20 COMMISSIONING PERFORMANCE VERIFICATION
- .1 Carry out Cx:
 - .1 Under operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
 - .2 Cx procedures to be repeatable and reported results are to be verifiable.
 - .3 Follow equipment manufacturer's operating instructions.
-

-
- .4 EMCS trending to be available as supporting documentation for performance verification.
- 1.21 WITNESSING COMMISSIONING
- .1 Departmental Representative to witness activities and verify results.
- 1.22 AUTHORITIES HAVING JURISDICTION
- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
 - .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
 - .3 Provide copies to Departmental Representative within [5] days of test and with Cx report.
- 1.25 EXTRAPOLATION OF RESULTS
- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.
- 1.25 EXTENT OF VERIFICATION
- .1 Number and location to be at discretion of departmental Representative.
 - .2 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
 - .3 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
 - .4 Perform additional commissioning until results are acceptable to Departmental Representative.
- 1.26 REPEAT VERIFICATIONS
- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.
-

-
- | | |
|--|---|
| 1.27 SUNDRY CHECKS
AND ADJUSTMENTS | .1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required. |
| 1.28 DEFICIENCIES,
FAULTS, DEFECTS | .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative. |
| 1.29 COMPLETION OF
COMMISSIONING | .1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative. |
| 1.30 ACTIVITIES UPON
COMPLETION OF
COMMISSIONING | .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item. |
| 1.31 TRAINING | .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training. |
| 1.32 MAINTENANCE
MATERIALS, SPARE PARTS,
SPECIAL TOOLS | .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract. |
| 1.33 OCCUPANCY | .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility. |
| 1.34 INSTALLED
INSTRUMENTATION | .1 Use instruments installed under Contract for TAB and PV if:
.1 Accuracy complies with these specifications.
.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted. |
| 1.35 PERFORMANCE
VERIFICATION
TOLERANCES | .1 Application tolerances:
.1 Specified range of acceptable deviations of measured values from specified values or |
-

specified design criteria. Except for special areas, to be within +/- 10% of specified values.

- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
 - .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.
- 1.36 OWNER'S PERFORMANCE TESTING
- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

PART 2 - PRODUCTS

- 2.1 NOT USED
- .1 Not Used.

PART3 - EXECUTION

- 3.1 NOT USED
- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

 - 1.2 REFERENCE STANDARDS
 - .1 Underwriters' Laboratories of Canada (ULC)
 - .2 Public Works and Government Services Canada (PSPC)
 - .1 PSPC - Commissioning Guidelines CP.4 -3rd edition-[03].

 - 1.3 GENERAL
 - .1 Provide a fully functional bridge and facilities:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Complete documentation relating to installed equipment and systems.
 - .2 Term "Cx" in this section means "Commissioning".
 - .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to handover to Owner.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
 - .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 O&M - Operations and Maintenance Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
-

- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

 - 1.4 DEVELOPMENT OF 100% CX PLAN
 - .1 Cx Plan to be 100% completed within 16 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
 - .2 Submit completed Cx Plan to Departmental Representative and obtain written approval.

 - 1.5 REFINEMENT OF CX PLAN
 - .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
 - .2 Revise, refine and update every month during construction phase. At each revision, indicate revision number and date.
 - .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
 - .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

 - 1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM
 - .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact (or designate) between members of commissioning team.
 - .2 Departmental Representative (or designate) will select Cx Team consisting of following members:
 - .1 Departmental Representative: during construction, will conduct periodic site reviews to observe general progress.
 - .2 Departmental Representative is responsible for:
 - .1 Monitoring operations Cx activities.
 - .2 Ensuring implementation of final Cx Plan.
-

- .3 Performing verification of performance of installed systems and equipment.
 - .4 Implementation of Training Plan.
 - .3 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .4 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
 - .5 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.
- 1.7 CX PARTICIPANTS
- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
 - .5 Client: responsible for site access and coordination with operations.
 - .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Changes to control strategies beyond level of training provided to O&M personnel.
 - .2 Redistribution of electrical services.
-

- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.
- 1.8 EXTENT OF CX
- .1 Commission mechanical systems and associated equipment:
 - .1 Machinery Systems:
 - .1 Pivot bearing assembly.
 - .2 Span drive cylinders and clevises.
 - .3 Live load bearing assemblies.
 - .4 Balance wheel assemblies.
 - .5 End castor assemblies.
 - .6 End lift assemblies.
 - .7 Span lock assembly.
 - .8 End stop assembly.
 - .2 Hydraulic systems:
 - .1 Motors and pumps.
 - .2 Reservoir and connections.
 - .3 Piping, tubing, hoses and their supports.
 - .4 Valve manifolds and valves.
 - .5 Hydraulic cylinders.
 - .6 Guard gate hydraulic connections.
 - .7 Hydraulic fluid.
 - .8 Operation of entire system including with single main pump and portable pump supplied by Owner. System shall be leak free.
 - .9 Hydraulic power unit enclosure.
 - .3 Control equipment:
 - .1 Limit switch brackets for span position.
 - .2 Commission electrical systems and equipment:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment including the utility meter, service disconnect and manual transfer switch.
 - .2 Low voltage distribution systems including MCC, Transformer, Lighting Panel.
 - .3 Surge Protection Device.
 - .4 All low voltage systems to remain in service.
 - .2 Emergency power generation systems:
 - .1 Generator receptacle.
 - .2 Manual transfer switch.
 - .3 Provide Portable Generator to Test System under generator power. The Contractor may coordinate with the owner to use their generator if available for testing.
 - .3 Control Equipment:
 - .1 Control Desk.
 - .2 Control Panel.
 - .3 AC and DC Hydraulic Controls for HPU 1 and HPU 2 for span operation, guard gate operation, span lock operation, and end lift operation.

- .4 Traffic and Pedestrian Gate Controls.
 - .5 Traffic Signal Controls.
 - .6 Navigation Lights Controls.
 - .4 Operating Equipment:
 - .1 Navigation Lights.
 - .2 Traffic and Pedestrian Gates.
 - .3 Traffic Signals.
 - .4 Gongs.
 - .5 HPU Systems and Equipment.
 - .5 Lighting systems:
 - .1 Lighting equipment include the hydraulic enclosure lights, receptacles, and fans.
 - .2 Distribution systems.
 - .6 Conduit, Duct, Wiring and Cabling:
 - .1 All electrical conductors.
 - .2 All electrical conduits and ducts.
- 1.10 DELIVERABLES RELATING TO O&M PERSPECTIVES
- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format.
 - .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 WHMIS information.
 - .5 MSDS data sheets.
 - .6 Electrical lighting panel inventory shall contain detailed typewritten inventory of electrical equipment and panel schedule circuitry for each panel board. Duplicate of inventory inside each panel.
 - .7 Electrical control panel and control desk inventory shall contain detailed typewritten inventory of electrical equipment and detailed circuitry drawings for each panel and desk. Duplicate of inventory inside each panel.
 - .8 Electrical Motor Control Center inventory shall contain detailed typewritten inventory of electrical equipment and detailed circuitry drawings for each motor control center bucket. Duplicate of inventory inside each motor control center bucket.
 - .9 Detailed conduit, duct, wiring, and cabling drawings showing all work, conduit tags, and wire numbers for the entire project.
- 1.11 DELIVERABLES RELATING TO THE CX PROCESS
- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
 - .2 Definitions:
-

- .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.

 - .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Training Plans.
 - .10 Cx Reports.
 - .11 Prescribed activities during warranty period.

 - .4 Departmental Representative to witness and certify tests and reports of results provided.
- 1.12 PRE-CX
ACTIVITIES AND
RELATED
DOCUMENTATION
- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor some of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Include completed documentation in Cx report.

 - .2 Pre-Cx activities - STRUCTURAL:
 - .1 Level and balance test: test level and balance of bridge is in accordance with contract documents. Coordinate with mechanical commissioning.

 - .3 Pre-Cx activities - MECHANICAL:
 - .1 Machinery and hydraulic systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete
-

- relevant documentation.
- .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
- .4 Pre-Cx activities - LIFE SAFETY SYSTEMS
 - .1 Include equipment and systems identified above.
 - .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .5 Pre-Cx activities - ELECTRICAL:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment including the utility meter, service disconnect and manual transfer switch.
 - .2 Low voltage distribution systems including MCC, Transformer, Lighting Panel.
 - .3 Surge Protection Device.
 - .4 All low voltage systems to remain in service.
 - .2 Emergency power generation systems:
 - .1 Generator receptacle.
 - .2 Manual transfer switch.
 - .3 Provide Portable Generator to Test System under generator power. The Contractor may coordinate with the owner to use their generator if available for testing.
 - .3 Control Equipment:
 - .1 Control Desk.
 - .2 Control Panel.
 - .3 AC and DC Hydraulic Controls for HPU 1 and HPU2 for span operation, guard gate operation, span lock operation, and end lift operation. Record all resistor and control equipment initial and final settings.
 - .4 Traffic and Pedestrian Gate Controls.
 - .5 Traffic Signal Controls
 - .6 Navigation Lights Controls
 - .4 Operating Equipment:
 - .1 Navigation Lights.
 - .2 Traffic and Pedestrian Gates.
 - .3 Traffic Signals.
 - .4 Gongs.
 - .5 HPU Systems and Equipment.
 - .5 Lighting systems:
 - .1 Lighting equipment include the hydraulic enclosure lights, receptacles, and fans.
 - .2 Distribution systems.
 - .6 Conduit, Duct, Wiring and Cabling:
 - .1 All electrical conductors.
 - .2 All electrical conduits and ducts.

-
- 1.13 START-UP
- .1 Start-up components, equipment and systems.
 - .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
 - .1 Hydraulic Power Units.
 - .2 Control System Set Points and Resistors, record final resistor and control system setpoints.
 - .3 Departmental Representative to monitor previously-identified start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
 - .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified to suit project requirements.
 - .3 Cx Agent to witness and certify reported results using approved PI and PV forms.
 - .4 Contractor to review completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative reserves right to verify reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.
- 1.14 CX ACTIVITIES AND RELATED DOCUMENTATION
- .1 Perform Cx by specified Cx agency using procedures approved by Departmental Representative.
 - .2 Departmental Representative to monitor Cx activities.
 - .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
 - .4 Contractor's Cx Agent to witness, certify reported results of, Cx activities and forward to Departmental Representative.
 - .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.
- 1.15 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION
- .1 Cx to be performed by specified Cx specialist, using procedures approved by Departmental Representative.
 - .2 Tests to be witnessed by Contractor's Cx specialist and documented on approved report forms.
-

- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be submitted to Departmental Representative for review.
- .4 Integrated systems to include:
 - .1 Hydraulic Power Unit (HPU), HPU Enclosure, Hydraulic Piping, and Hydraulic Cylinders.
 - .2 Control Panels, Control Desk, Hydraulic Equipment, Traffic Control Equipment, Gates, Gongs, and Navigation Lights.
 - .3 Span operation, lock operation, end lift operation, and guard gate operation.
 - .4 Manual Transfer Switch, Generator Receptacle, and Utility Service.
 - .5 Lighting, receptacle, and HVAC systems and HVAC systems.
- .5 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Contractor's Cx agent to complete inventory data sheets and provide assistance to Owner in full implementation of O&M identification system of components, equipment, sub-systems, systems.
- 1.16 INSTALLATION CHECK LISTS (ICL) .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.
- 1.17 PRODUCT INFORMATION (PI) REPORT FORMS .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.
- 1.18 PERFORMANCE VERIFICATION (PV) REPORT .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.
- 1.19 DELIVERABLES RELATING TO ADMINISTRATION OF CX .1 General:
 - .1 Complete Cx of weather and seasonal-sensitive equipment and systems.
- 1.20 CX SCHEDULES .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.
 - .4 Cx procedures: 3 months after award of

- contract.
- .5 Cx Report format: 3 months after contract award.
 - .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
 - .8 Notification of intention to start TAB: 21 days before start of TAB.
 - .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
 - .10 Notification of intention to start Cx: 14 days before start of Cx.
 - .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
 - .12 Identification of deferred Cx.
 - .13 Implementation of training plans.
 - .14 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Owner.
 - .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
 - .3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.
- 1.21 CX REPORTS
- .1 Submit reports of tests, witnessed and certified, to Departmental Representative who will review reported results.
 - .2 Include completed and certified PV reports in properly formatted Cx Reports.
 - .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.
- 1.22 ACTIVITIES DURING WARRANTY PERIOD
- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period.
- 1.23 TESTS TO BE PERFORMED BY OWNER/USER
- .1 None is anticipated on this project.
- 1.24 TRAINING PLANS
- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.
-

1.25 FINAL SETTINGS .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings and include in Cx Reports.

PART 2 - PRODUCTS

2.01 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.01 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
- .1 Commissioning forms to be completed for equipment, system and integrated system.
- 1.2 INSTALLATION/
START-UP CHECK LISTS .1 Include the following data:
- .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in O&M at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.
- 1.3 PRODUCT INFORMATION (PI) REPORT FORMS .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the O&M at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.
-

1.4 PERFORMANCE
VERIFICATION (PV)
FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF
COMMISSIONING FORMS

- .1 Contractor will develop and provide to Departmental Representative required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND
DEVELOPMENT OF
NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative

1.7 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.

- .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
- .9 Submit immediately after tests are performed.
- .10 Reported results in true measured SI unit values.
- .11 Provide Departmental Representative with originals of completed forms.
- .12 Maintain copy on site during start-up, testing and commissioning period.
- .13 Forms to be both hard copy and electronic format with typed written results in Operations & Maintenance Manual.

1.8 LANGUAGE .1 To suit the language profile of the awarded contract.

PART 2 - PRODUCTS

2.01 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.01 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
.1 This Section specifies roles and responsibilities of Commissioning Training.
- 1.2 TRAINEES .1 Trainees: personnel selected for operating and maintaining this facility. Includes facility operators, maintenance staff, security staff, and technical specialists as required.
.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.
- 1.3 INSTRUCTORS .1 Departmental Representative will provide:
.1 Descriptions of systems.
.2 Instruction on design philosophy, design criteria, and design intent.
.2 Contractor and certified factory-trained manufacturers' personnel to provide instruction on the following:
.1 Start-Up, operation, shut-down of equipment, components and systems.
.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
.3 Contractor and equipment manufacturer to provide instruction on:
.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.
- 1.4 TRAINING OBJECTIVES .1 Training to be detailed and duration to ensure:
.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
.2 Effective on-going inspection, measurements of system performance.
.3 Proper preventive maintenance, diagnosis and trouble-shooting.
.4 Ability to update documentation.
.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.
-

-
- 1.5 TRAINING MATERIALS
- .1 Instructors to be responsible for content and quality.
 - .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
 - .3 Training materials to be in a format that permits future training procedures to same degree of detail.
 - .4 Supplement training materials:
 - .1 Multimedia presentations.
 - .2 Manufacturer's training videos.
- 1.6 SCHEDULING
- .1 Include in Commissioning Schedule time for training.
 - .2 Deliver training during regular working hours, training sessions to be 1-2 hours in length.
 - .3 Training to be completed prior to acceptance of facility.
- 1.7 RESPONSIBILITIES
- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
 - .2 Departmental Representative will evaluate training and materials.
 - .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.
- 1.8 TRAINING CONTENT
- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
 - .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
-

- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O&M documentation.

- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

- 1.9 VIDEO-BASED TRAINING
 - .1 If applicable, Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.

 - .2 On-Site training:
 - .1 To be performed after systems are fully commissioned.
 - .2 Organize into several short modules to permit incorporation of changes.

PART 2 - PRODUCTS

- 2.01 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.01 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 02 41 13.14 - Asphalt Pavement Removal
 - .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- 1.2 REFERENCES
- .1 Canadian Standards Association (CSA International):
 - .1 S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
 - .2 National Fire Code of Canada (2010).
 - .3 Comply with the 2015 National Building Code of Canada (NBCC 2015), Division B, Part 8, "Safety Measures at Construction and Demolition Sites", and Provincial requirements.
 - .4 Federal and Provincial Legislation:
 - .1 Canadian Environmental Assessment Act (CEAA) 2012.
 - .2 Canadian Council of Ministers of the Environment (CCME).
 - .3 Canadian Environmental Protection Act (CEPA) 1999.
 - .4 Transportation of Dangerous Goods Act (TDGA) 1992.
 - .5 Occupational Health and Safety Act of the Province of Ontario.
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS): Material Safety Data Sheets (MSDS).
 - .6 Transport Canada (TC): Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.
 - .7 Site Specific Designated Substances and Hazardous Materials Survey (See Appendix E).
 - .8 Basic Impact Analysis (See Appendix C).
- 1.3 DEFINITIONS
- .1 Deconstruction: the systematic dismantling of a structure to salvage materials for reuse. What cannot be reused is considered subsequently for recycling. The ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been a significant portion of the waste system.
 - .2 Demolition: rapid destruction of a bridge with or without prior removal of designated/ hazardous substances. Recyclable materials may be pulled out from the resulting demolition debris.
-

- .3 Salvage: removal of structural and non-structural components from a structure during a deconstruction project for the purpose of reuse.
 - .4 Reuse: the use of a structure material in its original form and function (i.e. without drastic alteration by melting, shredding, pulverizing, etc.).
 - .5 Recycling: the use of a structure material which has been processed in some way for use in a form and function which is different from its original form and function.
 - .6 Waste Management Coordinator (WMC): a person or organization appointed to be responsible for supervising all waste management activities as well as coordinating all related, required submittal and reporting requirements.
 - .7 Designated and Regulated Substances: designated substances are substances that are known for their adverse effect on human health and the environment. These include but are not limited to asbestos, lead, mercury, arsenic, silicate, coke oven emissions, acrylonitrile, benzene, ethylene oxide, isocyanates, and vinyl chloride. Regulated substances include fuels, refrigeration and fire suppression fluids, and PCBs.
 - .8 Hazardous Materials: dangerous substances, chemicals and goods such as biological contaminants, poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or any other material that, if handled improperly, can endanger human health or well-being or the environment.
 - .9 Alternate Disposal: disposal at other than a landfill or an incineration plant. Alternate disposal includes salvage and delivery for reuse or delivery to an authorized facility for recycling.
 - .10 Departmental Representative: throughout this section, the term "Departmental Representative" shall refer to the on-site representative of the Project Management body.
 - .11 Target for this project is 75% diversion from landfill of Deconstruction, Demolition and Construction waste.
 - .12 Waste Audit (WA): detailed inventory of materials in building. Indicates quantities of reuse, recycling and landfill.
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during
-

- construction, demolition, deconstruction, or renovation project.
- .2 Indicates quantities of reuse, recycling and landfill.
 - .13 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- 1.4 ADMINISTRATIVE REQUIREMENTS
- .1 Site Meetings:
 - .1 Convene pre-demolition meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07 - Construction Progress Schedules: Bar Chart (GANTT) to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .3 Hold project meetings every week.
 - .4 Ensure key personnel attend meetings. WMC should be present at all site meetings to report on the status of waste diversion.
 - .5 Reporting Requirements: WMC to complete.
 - .6 WMC must provide written report on status of waste diversion activity at each meeting.
 - .7 Departmental Representative will provide written notification of change of meeting schedule established upon contract award 24 hours prior to scheduled meeting.
 - .2 Scheduling: meet project time lines without compromising specified minimum rates of material diversion.
 - .1 Notify Departmental Representative in writing when unforeseen delays occur.
 - .3 Contractor shall be specialized in performing the work of this section with documented experience in similar types of deconstruction projects. Contractor to submit documentation of experience for review by Departmental Representative.
 - .4 Contractor shall provide a qualified and competent supervisor with previous experience in deconstruction work who shall be present at all times during the deconstruction activities and who shall direct all work and Contractor to submit documentation of supervisor's experience for review by Departmental Representative.
-

Designate a person on site who would be responsible for worker and general public safety and who will maintain project site safety procedures and requirements and in accordance with Section 01 35 29.06 - Health and Safety Requirements.

- .5 Ensure workers and subcontractors employed on the project are trained to carry out work in accordance with the appropriate deconstruction techniques.

1.5 REGULATORY
REQUIREMENTS

- .1 Conform to applicable codes and regulations for deconstruction of structures, safety of adjacent structures, noise and dust control, removal of common and hazardous waste and disposal.
- .2 Complete all deconstruction work according to the requirements of the Canadian Construction Safety Code, Provincial Labour and WSIB - Workers Safety and Insurance Board Regulations and Waste Management regulations.
- .3 Obtain required authorization, certificates and permits from authorities having jurisdiction.
- .4 Notify Departmental Representative and affected utility companies before starting work, and comply with their requirements.
- .5 Do not close or obstruct safety exits, adjacent sidewalks, hydrants, parking or storage areas without prior approval of Departmental Representative.
- .6 Conform to applicable regulatory procedures when discovering hazardous or contaminated materials that were not previously documented.
- .7 Only those resale/brokerage, storage, recycling, transfer and/or disposal facilities which comply with the provincial and municipal regulations and by-laws shall be used by the Contractor for the disposal of materials generated at the deconstruction project.

1.6 PERFORMANCE
REQUIREMENTS

- .1 Salvage materials from the structure and site. Segregate unsalvageable for recycling to achieve maximum diversion of waste that otherwise would be destined for landfill disposal.

1.7 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed

- in the Province of Ontario, Canada.
- .2 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
 - .2 Hazardous Materials:
 - .1 Provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
 - .3 Waste Reduction Workplan:
 - .1 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Time and date of removal.
 - .3 Weight, volume or quantity of material.
 - .4 Breakdown of reuse, recycling and landfill percentages or quantities.
 - .5 Schedule of selective demolition.
 - .6 Number and location of dumpsters.
 - .7 Anticipated frequency of tipping.
 - .8 Name and address of certified/authorized equipment dismantlers, material haulers, receivers and/or end users of salvaged materials, recycling facilities and waste receiving organizations.
 - .4 Certificates:
 - .1 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site on weekly basis.
 - .2 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
 - .5 Submit plans stamped and signed by qualified professional engineer registered or licensed in the Province of Ontario, Canada.
 - .6 Workers, haulers and subcontractors shall possess applicable, current licenses, Certificates of Approval, and/or permits to remove, handle, transport and dispose of materials provincially, municipally, and/ or federally categorized as designated, hazardous or otherwise regulated substances. Upon written request, submit proof of
-

compliance to Departmental Representative within 24 hours.

- 1.8 QUALITY ASSURANCE .1 Ensure work is performed in compliance with all applicable federal legislation including CEPA, CEAA, TDGA, MVSA and all applicable provincial regulations and municipal bylaws.
- .2 Document work activities and produce evidence of compliance immediately upon request by Departmental Representative and/or respective regulatory body.
- 1.9 DELIVERY, STORAGE AND HANDLING .1 Store and manage hazardous materials in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
- .2 Storage and Protection:
- .1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
- .3 Remove and store materials to be salvaged, in manner to prevent damage.
- .4 Store and protect in accordance with requirements for maximum preservation of material.
- .5 Handle salvaged materials as new materials.
- .3 Develop Waste Reduction Workplan related to Work of this Section.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.
- 1.10 SITE CONDITIONS .1 Site Environmental Requirements:
- .1 Perform work in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
- .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Do not dispose of waste or volatile materials including but not limited to, mineral

- spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
- .1 Ensure proper disposal procedures are maintained throughout the project.
 - .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local regulatory authorities.
 - .6 Protect trees, plants and foliage on site and adjacent properties.
- .2 Existing Conditions:
- .1 Remove contaminated or hazardous materials as defined by authorities having jurisdiction from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance with TDGA and other applicable regulatory requirements.
 - .3 Contractor shall accept the site as it exists and will be responsible for all deconstruction work as required.
 - .4 Prior to start of work, arrange for a site visit together with Departmental Representative to examine existing exterior and interior site conditions and adjacent structures. Where applicable, the Contractor at his expense shall be responsible for taking pictures of any existing damage to adjacent structures and record same in writing to avoid any disputes at a later date.
 - .5 Where materials or conditions revealed appear to be other than those normally expected or indicated in the Contract documents, the Contractor shall immediately inform the Departmental Representative, should such variance of conditions or materials result in a contemplated change to the cost of the work. Should an alternate method of deconstruction or change of materials be appropriate, the Departmental Representative shall immediately give his decision before the work proceeds.
 - .1 If material resembling spray or trowel applied asbestos or any other designated or listed as hazardous substance be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.
 - .2 Ensure compliance with the handling,
-

transportation and disposal requirements of fuels, PCBs, halocarbons and other regulated substances that are likely to be encountered during removal, disassembly or dismantling of mechanical and electrical equipment.

.3 Prior to dismantling and removal of equipment specified for salvage, clearly label all parts/components of mechanical systems to facilitate re-assembly, as applicable.

.4 Appropriately label and package all components and parts of mechanical and electrical materials specified for salvage to prevent damage or loss.

.6 Protection:

.1 Prevent movement, settlement or damage of adjacent structures and services. Provide bracing and/or shoring as required. Repair damage caused by deconstruction as directed by Departmental Representative.

.2 Support affected structures and, if safety of structure being deconstructed or adjacent structures or services appears to be endangered, take preventative measures, cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking emergency exit routes, adjacent navigation canal, surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

1.11 ENVIRONMENTAL
PROTECTION

.1 Execute work in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

.2 Dispose of mechanical and electrical components not designated to be salvaged in accordance with applicable regulations.

.3 Pressure washing or sandblasting of the existing steel superstructure (to eliminate guano) is not permitted.

1.12 SCHEDULING

.1 Ensure project time lines are met without compromising specified minimum rates of material salvage, recovery or diversion. Notify Departmental Representative in writing of delays.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Employ equipment and techniques to maximize material salvage potential and segregate all recyclable materials.

- .2 Equipment and heavy machinery used during course of demolition shall meet or exceed all applicable emission requirements, operate in compliance with EPA CFR 86.098-10, Emission Standards for 1998 and Later Model Year Otto-Cycle Heavy Duty Engines and Vehicles and EPA CFR 86.098-11, Emission Standards for 1998 and Later Model Year Diesel Heavy Duty Engines and Vehicles and MVSA.
- .3 Leave equipment and machinery running only while in use, except where extreme cold temperatures prohibit shutting down.
- .4 Use water misting or water efficient wetting equipment/trucks/attachments for dust suppression.
- .5 Demonstrate that all equipment and tools are being used in a manner which allows for the salvage of materials in best condition possible.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Disconnect and re-route electrical, mechanical, and any communication service lines entering structure to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other installations during period of deconstruction.
- .3 Locate and protect utility lines. Do not disrupt active or energized utilities traversing the construction site limits.
- .4 Notify and obtain approval of utility companies before starting demolition.
- .5 Disconnect and cap designated mechanical services.
 - .1 Other underground services: remove and dispose of as directed by Departmental Representative.
- .6 Remove trees and shrubs only when necessary and with Departmental Representative's written approval. Where practically possible, remove trees and shrubs and temporarily store in a manner and condition for re-planting on-site or elsewhere.
- .7 Post signs in visible locations and appropriate languages to alert workers, subcontractors, haulers, and public to the job site hazards,

travel routes, location of on-site processing and stockpiling of each material, material storage bin location and use, e.g. "CLEAN WOOD ONLY".

3.2 PROTECTION

- .1 Carry out work with minimum or no interference to public or private accesses. Maintain protected egress and access at all times.
- .2 Ensure that deconstruction work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
- .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties. Control runoff or disposal of water containing suspended materials or other harmful substances in accordance with local authorities.
- .5 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .6 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during deconstruction activities.
- .7 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust and mud tracking on all temporary roads.
- .8 Stop work immediately if adjacent installations or structures appear to be in danger. Notify Departmental Representative. Do not resume work until directed by Departmental Representative.
- .9 Provide, install and maintain all necessary and/or legally required railings, guards and warning signs during execution of the work to fully protect all persons from loss, damage, death or injury.
- .10 It is the Contractor's responsibility to ensure that the methods, equipment and/or techniques used during the deconstruction activities do not overload or undermine any structural members or jeopardize the overall safety of the operation.
- .11 It is the responsibility of the Contractor to design, provide, install and maintain an adequate

temporary shoring and/or bracing that may be required during the deconstruction activities.

- .12 Protect existing structures, equipment and machinery which are not to be dismantled or salvaged. Protect from damage all property and site improvements in the immediate surroundings of the project area. Make good all damages to property and improvements including sidewalks, curbs, landscaped or paved areas and other finishes that may be damaged during execution of the deconstruction work.
- .13 Prevent debris from blocking the marine canal, surface drainage systems, exits, travel routes, adjacent navigation canal, mechanical and electrical systems that are to remain in operation.
- .14 It is the Contractor's responsibility to design, provide, install and maintain all necessary lighting and temporary fire protection requirements.

3.3 REMOVAL OF HAZARDOUS WASTES

- .1 Prior to start of deconstruction work identify and remove all designated and hazardous substances as defined by authorities having jurisdiction and other materials contaminated by such substances as directed by Departmental Representative. Handle in a safe manner and transport in accordance with TDGA and provincial/regional regulations/by-laws and dispose of at facilities authorized to receive the respective materials in accordance with the applicable regulatory requirements.
 - .1 Remove hazardous materials and handle in a safe manner in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Dispose of hazardous materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.4 DISASSEMBLY

- .1 Materials removed from bridge structures are property of Contractor.
- .2 Throughout the course of deconstruction, pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to salvageable materials and equipment.
- .3 Deconstruct in accordance with CSA S350 and all other applicable safety regulations, codes, guidelines and standards.

- .4 Workers must utilize adequate fall protection where necessary.
- .5 Maintain structural integrity of structure at all times.
- .6 Systematically remove all mechanical, hydraulic and electrical equipment as indicated on Contract drawings.
- .7 Remove, protect and store salvaged items as identified in the contract drawings.
- .8 Completely drain hydraulic oil from existing hydraulic cylinders, hydraulic power unit, valves and the exiting tube and piping. Dispose oil in accordance with regulations.
- .9 Disconnect electrical power from all existing devices to be removed, hydraulic power unit, valves, limit switches etc. Follow all lock-out and tag-out procedures.
- .10 Wherever possible, transfer material assemblies from heights to ground level for easier disassembly. Take all appropriate measures to ensure safety.
- .11 Carefully and methodically separate and segregate materials into reusable, recyclable and waste streams.
- .12 At end of each day's work, leave work in safe and stable condition.

3.5 DEMOLITION

- .1 Concrete Removal (in accordance with OPSS 928 latest edition):
 - .1 Concrete Removal Type "C" - Upper portion of the ballast wall on the east and west abutments as indicated in the contract drawings. Excavation required in providing adequate room for removal and subsequent placement of concrete shall be included in the removal item. Existing vertical reinforcing steel is to remain and be cleaned.
 - .2 Concrete Removal Type "C" - Upper portion of the abutment wall on the east and west abutments as indicated in the contract drawings. Existing vertical reinforcing steel is to remain and be cleaned.
 - .3 Concrete Removal Type "C" - Upper portion of the pivot pier as indicated in the contract drawings. Existing reinforcement is to remain, where possible, and be cleaned.
 - .4 Minimize dust during the removals and keep materials wetted as directed by Departmental

Representative.

.5 Remove existing concrete by hand-held jackhammer (chipping hammers) to minimum depths indicated on the drawings or as directed by the Departmental Representative. Removals exceeding the limits indicated on the drawings will only be paid if authorized by the Departmental Representative in writing.

.1 Take special care not to damage the layer of concrete beyond the depth of removal limit by using jackhammers of appropriate weights.

.2 Demolish existing bridge superstructure and parts of the substructure as indicated in the Contract Drawings. Maintain structural integrity at all times during the demolition of the superstructure and substructure.

.3 All steel removed from existing superstructure is to be recycled. Re-use of existing steel is not permitted.

.4 All existing Guide Rails to be removed shall be salvaged and delivered to the client.

3.6 PROCESSING

.1 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.

.2 Stock materials in manner which ensures best possible condition of salvaged materials.

.3 Keep processing area clean, organized and free of debris.

.4 Supply separate, clearly marked disposal bins for all categories of materials. Do not remove waste bins from site until inspected and approved by Departmental Representative. Notify Departmental Representative prior to removal of any material bins from site.

.5 Separate and prepare processed materials into organized piles for proper handling and storage or transportation. Provide collection area for materials processed.

3.7 STORAGE AND STOCKPILING

.1 Store salvaged materials in designated secure areas and protect from the elements. Clearly label all stockpiles, indicating material type and quantity.

.2 Employ reasonable means necessary to protect salvaged materials from vandalism, theft, adverse

weather or inadvertent damage by heavy machinery. Designate a worker, hire security, erect temporary fencing as necessary.

- .3 Stockpile materials designated for off-site destinations in locations which facilitate removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
- .4 Maximum permitted duration of material storage on site is between commencement and completion dates stipulated in Section 01 14 00 - Work Restrictions of the contract documents.

3.8 TRANSPORTATION AND
DISPOSAL

- .1 Load, transport salvaged material and unload at destination so that material is delivered in condition that is acceptable to the end user.
- .2 Transport recyclable materials in appropriate containers and in accordance with applicable provincial/territorial and municipal requirements.
- .3 Transport solid waste, contaminated materials and/or hazardous materials/waste in accordance with TDGA and related provincial/territorial and municipal regulations and by-laws. Contaminated materials and waste must be transported by appropriately licensed/authorized haulers.
- .4 Salvaged reusable materials, recyclables, waste, and contaminated or hazardous materials removed from the project site shall be transported by and delivered to appropriately licensed or authorized haulers, facilities and receiving organizations listed in waste reduction work plan. Do not deviate from haulers, facilities and receiving organizations listed in waste reduction work plan without prior written authorization from Departmental Representative.
- .5 Recyclable materials, solid waste, contaminated or hazardous materials removed from the site shall be disposed of at appropriately licensed or authorized facilities only in accordance with Section 01 74 19 - Waste Management and Disposal. Contractor shall provide legal evidence of appropriate disposal to the Departmental Representative.
- .6 Individuals or organizations receiving salvaged reusable materials must forever indemnify the owner and the project team against all claims arising from handling, transportation, and use of the materials. Contractor is responsible to obtain such legal indemnification to the

Departmental Representative's satisfaction.

3.9 CLEANING AND
RESTORATION

- .1 Keep site clean and organized throughout deconstruction activities on a daily basis. Clean before the end of each workday.
- .2 Upon completion of project, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Fires and burning of waste or materials is not permitted on-site.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .5 Do not bury material on-site.
- .6 Upon completion of project, reinstate all areas, parking surfaces, walkways, light standards, landscaping, and other adjacent areas or structures affected by Work to condition which existed prior to commencement of Work or better.
- .7 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Section includes descriptions for demolishing, salvaging, recycling and removing of asphalt paving identified in whole or in part, and for backfilling trenches and excavations resulting from site demolition activities as required by scope of work.
- 1.2 RELATED SECTIONS .1 Section 02 41 13 - Selective Site Demolition
- 1.3 REFERENCES .1 U.S. Environmental Protection Agency (EPA) / Office of Water:
.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
.2 Department of Justice Canada (Jus):
.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
.2 Canadian Environmental Protection Act, 1999 (CEPA), c. 33.
- 1.4 DEFINITIONS .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
.2 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled
.3 Draft Waste Reduction Workplan (Draft WRW Plan): Detailed inventory of materials indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 19 - Waste Management and Disposal and as follows:
.1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
.4 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
.5 Waste Reduction Workplan (WRW): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.
-

- .6 Waste Reduction Workplan Report (WRW Report):
Written report identifying actual materials that formed WRW for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal.

 - 1.5 ADMINISTRATIVE REQUIREMENTS
 - .1 Coordination: Coordinate requirements for Waste Management and Disposal for materials being re-used or recycled in accordance with Section 01 74 19 - Waste Management and Disposal:
 - .1 Divert excess materials from landfill.
 - .2 Separate materials identified for recycling place in identified areas in accordance with Waste Reduction Workplan.
 - .3 Label location of salvaged material's storage areas and provide barriers and security devices.
 - .4 Remove materials that cannot be salvaged for re use or recycling and dispose of in accordance with applicable codes at licensed facilities.
 - .2 Pre Construction Meeting: Arrange a pre construction meeting in accordance with Section 01 31 19 - Project Meetings; attended by Contractor's key personnel, waste management coordinator and Departmental Representative to discuss the following:
 - .1 Verify project requirements.
 - .2 Review site conditions.
 - .3 Coordination with other Subcontractor's affected by work of this Section.
 - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .5 Waste reporting requirements.

 - 1.6 SUBMITTALS
 - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Action Submittals: Provide following submittals before starting work of this Section:
 - .1 Shop Drawings: Submit shop drawings indicating diagrams or details showing sequence of demolition work.
 - .3 Informational Submittals: Provide following submittals during course of work:
 - .1 Certificates: Submit copies of certified weigh bills, bills of lading or receipts from authorized disposal sites and re use and recycling facilities for material removed from site on weekly basis.
-

- .4 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
 - .2 Waste Reduction Workplan (WRW): Submit project WRW highlighting recycling and salvage requirements in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .3 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .4 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

 - 1.7 QUALITY ASSURANCE
 - .1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.
 - .2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

 - 1.8 SITE CONDITIONS
 - .1 Protect existing site features to remain or identified for salvage or re use; make repairs and restore to a similar condition to existing where damage to these items occurs as directed by Departmental Representative and at no cost to Owner:
 - .1 Remove and store salvaged materials to prevent contamination.
 - .2 Store and protect salvaged materials as required for maximum preservation of material.
 - .3 Handle salvaged materials same as new materials.
 - .2 Perform pavement removal work to prevent adverse effects to adjacent watercourses, groundwater and wildlife, and to prevent excess air and noise pollution:
 - .1 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Authorities Having Jurisdiction.
 - .3 Protect existing site features and structures, trees, plants and foliage on site and adjacent properties.
-

PART 2 - PRODUCTS

- 2.1 EQUIPMENT
- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.
 - .2 Where full depth removal is required, all edges shall be saw cut.

PART 3 - EXECUTION

- 3.1 PREPARATION
- .1 Verify extent and location of asphalt identified for removal, disposal, alternative disposal, recycling, salvage and items to remain.
 - .2 Locate and protect utilities, preserve active utilities traversing site in operating condition.
 - .3 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements or authorities having jurisdiction, or sediment and erosion control drawings, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Do not remove erosion and sedimentation controls without written approval from Departmental Representative. Restore and stabilize areas disturbed during removal after completion of demolition work.
 - .4 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.
 - .5 Protection: protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.
- 3.2 REMOVAL
- .1 Remove existing asphalt pavement to lines and grades as indicated established by Departmental Representative on site.
 - .2 Demolition of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method

- acceptable to Departmental Representative on site.
- .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials where they are exposed and identified to remain.
 - .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .3 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
 - .4 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
 - .5 Suppress dust generated by removal process.
 - .6 Operations to include removing, hauling, stockpiling designated pavement and cleaning of remaining pavement surface.
 - .7 This item includes transportation of all materials including asphalt tack coat and asphalt binder, production, handling, preparation of surface, placing (including material transfer device), rolling and compaction of asphalt concrete base course.
- 3.3 FINISH TOLERANCES
- .1 Finished surfaces in areas where asphalt pavement has been removed to be within +/-5 mm of grade specified but not uniformly high or low.
- 3.4 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooms as required.
 - .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
-

- .2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this contract may be stockpiled at designated asphalt plant site.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 33 71 73.02 - Underground Electrical Service
- 1.2 REFERENCES .1 Canadian Standards Association (CSA International):
.1 CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.
.2 Department of Justice Canada (Jus):
.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
.2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
.3 U.S. Environmental Protection Agency (EPA):
.1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles.
.2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles.
.3 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.3 DEFINITIONS .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
.2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
.3 Waste Audit (WA): detailed inventory of materials in structure. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
.4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
-

1.4 ADMINISTRATIVE
REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work.
 - .3 Co-ordinate with other construction subtrades.
 - .2 Hold project meetings every week.
 - .3 Ensure key personnel attend.
 - .4 WMC must provide written report on status of waste diversion activity at each meeting.
 - .5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .2 Scheduling:
 - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 In event of unforeseen delay, notify Departmental Representative in writing.

1.5 DESCRIPTION

- .1 This section specifies requirements for demolishing and removing wholly or in part various items designated to be removed or partially removed.
- .2 Demolition and removal will consist of, but not necessarily be limited to, the following:
 - .1 Remove existing bridge structure, including but not limited to Abutment structures (or portions thereof), wing walls, existing foundations, bridge railings and posts, expansion joints.
 - .2 Remove existing signage, as indicated.
 - .3 Remove excess fill materials.

1.6 PROTECTION

- .1 Protect existing objects designated to remain. In event of damage, immediately replace or make repairs to approval of, and at no additional cost to, Departmental Representative.

1.7 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 19 - Waste Management and Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 19- Waste Management and Disposal and indicate:

- .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tipping.
 - .5 Name and address of haulers and waste receiving organizations.
- .4 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site on a weekly basis.
- .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
- .5 Shop Drawings:
- .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
 - .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .6 Sustainable Design Submittals:
- .1 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with the requirements of the authority having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
- 1.8 QUALITY ASSURANCE .1 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial and Municipal regulations.
- 1.9 SITE CONDITIONS .1 Environmental protection:
- .1 Ensure Work is done in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .3 Fires and burning of waste or materials is not permitted on site.
 - .4 Do not bury rubbish waste materials.
 - .5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic
-

cleaning solutions into watercourses, storm or sanitary sewers.

- .1 Ensure proper disposal procedures are maintained throughout project.
- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .9 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

1.10 EXISTING
CONDITIONS

- .1 If material resembling spray or trowel applied asbestos, or other designated substances listed as hazardous, be encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions has been received from Departmental Representative.
- .2 Structures to be demolished are based on their condition at time of examination prior to tendering.
 - .1 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Equipment and heavy machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations and CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .2 Off-road vehicles to: EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or

airborne dust to adjacent properties and walkways, according to: sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

- .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
- .3 Do not remove erosion and sedimentation controls without written approval from Departmental Representative. Restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of in-place conditions:
 - .1 Work in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades and properties.
 - .1 Provide bracing, shoring and underpinning as required.
 - .2 Repair damage caused by demolition as directed by Departmental Representative.
 - .3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
 - .4 Prevent debris from blocking surface drainage system, which must remain in operation.
- .3 Surface Preparation:
 - .1 Disconnect and re-route electrical and telephone service lines affected by structure demolition.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
 - .2 Disconnect and cap designated mechanical services.
 - .1 Other underground services: remove and dispose of as directed by Departmental Representative in accordance with Section 33 71 73.02 - Underground Electrical Service.
 - .3 Do not disrupt active or energized utilities traversing premises, designated to remain undisturbed.
 - .4 Remove rodent and vermin as required by Departmental Representative.

3.2 DEMOLITION

- .1 Blasting operations not permitted during demolition.
- .2 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in

safe manner to minimize danger at site or during disposal.

- .3 Prior to start of Work remove contaminated or hazardous materials listed as hazardous from site and dispose of at designated disposal facilities in safe manner and in accordance with TDGA and other applicable requirements. Refer Existing Conditions in PART 1.
 - .4 Demolish structure to permit structure replacement in accordance with contract documents. Including demolition and removal of existing bridge superstructure, including but not limited to: deck, curbs, railings, and girders. This item also includes complete demolition and removal of portions of the existing foundations of existing bridge including but not limited to the East abutment, West abutment and central pivot pier. This item also includes removal of mechanical components in accordance with Section 29 05 00. This item also includes excavation of all material of whatever nature encountered, to access existing foundations for demolition and water control.
 - .5 Permit replacement structure, as required by authority having jurisdiction.
 - .6 Crush concrete generated due to demolition of foundations to size suitable for recycling as directed.
 - .1 Where possible identify markets which will accept crushed material as aggregate.
 - .2 For further information regarding acceptable uses contact Provincial aggregate producers associations.
 - .7 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
 - .8 At end of each day's work, leave Work in safe and stable condition.
 - .9 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
 - .10 Only dispose of material specified by selected alternative disposal option as directed by Departmental Representative.
 - .1 Additional disposal options to be provided by Departmental Representative, on-site waste diversion representative prior to disposal.
 - .11 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
-

- .12 Use natural lighting to do Work where possible. Shut off lighting except those required for security purposes at end of each day.

3.3 EXECUTION

- .1 Inspect site and verify with Departmental Representative objects designated for removal.

3.4 REMOVAL

- .1 Remove in their entirety all materials and objects specified for removal. Inspect site and verify with departmental Representative objects designated for removal
- .2 Do not disturb adjacent work designated to remain in place.

3.5 SAFETY CODE

- .1 Do demolition work in safe manner and according to applicable laws and regulations from authorities having jurisdiction.
- .2 Blasting is not permitted.

3.5 DISPOSAL OF MATERIALS

- .1 The Departmental Representative maintains the right of first refusal (at no cost) to demolished material except those designated for reuse.
- .2 Upon refusal of demolished materials by the Departmental Representative, such materials become the property of the Contractor. Remove such materials from sites and dispose in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 CLEANING

- .1 Develop Waste Reduction Workplan related to Work of this Section.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to site approved Departmental Representative.
- .4 Designate appropriate security resources /measures to prevent vandalism, damage and theft.
- .5 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .6 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

- .1 Label stockpiles, indicating material type and quantity.
- .7 Separate from general waste stream each of following materials. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
 - .1 Wiring and conduit.
 - .2 Electrical Equipment.
 - .3 Mechanical Equipment.
 - .4 Metals.
 - .5 Concrete.
 - .6 Asphalt.
- .8 Supply separate, clearly marked disposal bins for categories of waste material. Please notify Departmental Representative prior to removal of bins from site.
- .9 Stockpile on site wiring and conduit, and metals in good condition for reuse in new construction.
- .10 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project construction.
- .11 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .12 Transport material designated for alternate disposal using approved haulers and receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers and receiving organizations listed in Waste Reduction Workplan.
- .13 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.
- .14 Upon completion of work, remove debris, trim surfaces and leave work site in clean condition
- .15 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY .1 This Section includes requirements for careful removal and salvage, and reconditioning of bridge components identified for storage at a designated remote site and subsequent reinstallation forming a part of Project ready for re use at a later date.

- 1.2 RELATED REQUIREMENTS .1 Section 02 41 13 - Selective Site Demolition
 .2 Section 02 41 16 - Structure Demolition

- 1.3 DEFINITIONS .1 Remove and Salvage: Detach items from existing construction and deliver them to Department Representative ready for reuse.
 .2 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

- 1.4 ADMINISTRATIVE REQUIREMENTS .1 Coordination Existing Salvaged Work: Coordinate with Departmental Representative for confirmation of materials, components, and items of equipment identified for removal and salvage from their present existing locations and as follows:
 - .1 Items that are turned over to Departmental Representative.
 - .2 Off site storage locations.
 - .3 Confirmation of items that are renovated or refurbished ready for reinstallation as a part of Work.
 - .4 Confirmation of items that Departmental Representative will not reuse, but will retain will be as indicated in Section 2.1 SALVAGED ITEMS following but not limited to.
 - .1 Contractor is responsible for loading, handling, transporting and delivering, or making available for pick-up, all salvaged items as indicated by the Departmental Representative.

PART 2 - PRODUCTS

- 2.1 SALVAGED ITEMS .1 Items salvaged by Constructor and retained by Departmental Representative include, but are not limited to:

Work	Deliver to
All existing guiderails removed from site to be salvaged	Storage facility/site location designated by the Departmental Representative: 2155 Ashburnham Drive, Peterborough, ON K9J 6Z6
The following mechanical items to be removed from bridge and made available on-site include but are not limited to:	Contractor to make available on site for pick up by Departmental Representative.

<ul style="list-style-type: none">.1 Existing pivot bearing assembly..2 Existing drive cylinders and support brackets..3 Existing live load bearing assemblies..4 Existing balance wheel assemblies..5 Existing balance wheel track and anchorage system..6 Existing end castor assemblies..7 Existing end wedge assembly, including cylinders..8 Existing center latch assembly, including cylinder and pier mounted latch pocket..9 Existing rigid stop..10 Existing hydraulic lines that run between the existing hydraulic power unit and swing span mechanical component cylinders..11 Existing hydraulic power unit located in the gate house.	
--	--

- .2 Components not designated by the Departmental Representative for pick up shall be disposed of by the Contractor in accordance with all federal, provincial and local regulations, including paint, lubricants and other hazardous materials.
- .3 Confirm with Departmental Representative additional items that appear salvageable prior to disposal.

PART 3 - EXECUTION

3.1 SALVAGE

- .1 Remove and handle salvageable items from site to minimize damage and to ensure that usability is maintained.
- .2 Clean, decontaminate, or remediate hazardous substances (lead based paint, asbestos dust, PCB residue, and similar substances) from salvaged materials so they are safe for reuse.
- .3 Place materials on palettes or wrap in protective film to ensure that loose pieces and projections do not cause injury to personnel, and that salvaged items remain as complete units.
- .4 Clean items of construction or building debris, or materials that are not a part of salvaged work before delivering to Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 02 41 13 - Selective Site Demolition
- 1.2 SUMMARY .1 Comply with requirements of this Section when performing following Work:
- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on structure.
 - .2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter on structure.
 - .3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding on structure.
- 1.3 REFERENCES .1 Ontario Ministry of Labour:
- .1 Occupational Health and Safety Branch, Guideline Lead On Construction Projects, September 2004, and O. Reg. 490/09 respecting Designated Substances - Lead made under the Occupational Health and Safety Act as amended by O. Reg. 148/12 and O. Reg. 149/12.
 - .2 Department of Justice Canada:
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .3 Health Canada:
 - .1 Workplace Hazardous Materials Information System (WHMIS), Safety Data Sheets (SDS).
 - .4 Human Resources and Social Development Canada (HRSDC):
 - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
 - .5 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
 - .6 U.S. Environmental Protection Agency (EPA):
 - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
 - .7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH):
 - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
 - .8 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances:
 - .1 Lead in Construction Regulation - 29 CFR
-

1926.62-1993.

- .9 Underwriters' Laboratories of Canada (ULC)
- .10 Site Specific Designated Substances and Hazardous Materials Survey (See Appendix E).
- .11 Basic Impact Analysis (See Appendix C).

1.4 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Departmental Representative or designated representatives.
- .3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic meter of air (50 ug/m³) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic meter of air for removal of lead based paint.
- .6 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.
- .7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having

jurisdiction.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Execute construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in work area include:

.1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.

.2 Respirators should not be necessary if general work procedures are followed and if level of lead in the air is less than 0.05 mg/m².

.2 Eating, drinking, chewing, and smoking are not permitted in work area.

.3 Ensure workers wash hands and face when leaving work area. Facilities for washing are to be located within the work area by the Contractor.

.4 Visitor Protection:

.1 Provide approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors procedures to be followed in entering and exiting work area.

-
- 1.7 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
 - .4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.
- 1.8 EXISTING CONDITIONS
- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
 - .2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.
- 1.9 SCHEDULING
- .1 Not later than two days before beginning Work on this Project notify following in writing:
 - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
 - .2 Provincial Ministry of Labour.
 - .3 Disposal Authority.
 - .2 Inform sub-trades of presence of lead- containing materials identified in Existing Conditions.
 - .3 Provide Departmental Representative copy of notifications prior to start of Work.
 - .4 Hours of Work: perform work involving demolition of the Warsaw Road Swing Bridge located at the Trent-Severn Waterway outside of normal working hours.

Include in Contract Sum additional costs due to this requirement.
- 1.10 OWNER'S INSTRUCTIONS
- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators where
-

used.

- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

1.11 PERSONNEL TRAINING

- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training in accordance with Section 01 79 00 - Demonstration and Training.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.
- .4 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.
 - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

- 3.1 SUPERVISION .1 One Supervisor for every ten workers is required.
- .2 Supervisor must remain within work area during disturbance, removal, or handling of lead based paints.
- 3.2 PREPARATION .1 Remove and store items to be salvaged or reused.
- .1 Protect and wrap items and transport and store in area specified by Departmental Representative.
- .2 Work Area:
- .1 Shut off and isolate HVAC system to prevent dust dispersal into other structure areas. Conduct smoke tests to ensure duct work is airtight.
- .2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
- .3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
- .4 Seal off openings with polyethylene sheeting and seal with tape.
- .5 Protect floor surfaces covered from wall to wall with polyethylene sheets.
- .6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
- .7 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.
- .8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.
- .3 Do not start work until:
- .1 Arrangements have been made for disposal of waste.
- .2 Tools, equipment, and materials waste containers are on site.
- .3 Arrangements have been made for structure security.
- .4 Notifications have been completed and preparatory steps have been taken.
- 3.3 LEAD ABATEMENT .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or

removal with using power tools, non-powered hand tool, other than manual scraping and sanding.

- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport. Seal filled containers.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours; no entry, activity, ventilation, or disturbance during this period.

3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.
- .2 Departmental Representative will inspect work for:
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

- .1 Final lead surface sampling to be conducted as follows:
 - .1 After work area has passed a visual inspection for cleanliness approved and accepted by Departmental Representative. Apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental

Representative will perform lead wipe sampling.

- .1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.
- .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
- .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEAN-UP

- .1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 02 41 16 - Structure Demolition
- 1.2 REFERENCES .1 Canadian Standards Association (CSA International):
.1 CSA-A23.1-09(R2014) - Concrete Materials and Methods of Concrete Construction.
.2 OPSS 928 Structure Rehabilitation - Concrete Removal
.3 OPSS 929 Abrasive Blast Cleaning - Concrete Construction
.4 OPSS 930 Structure Rehabilitation - Concrete Patches and Overlay.
- 1.3 ENVIRONMENTAL CONDITIONS .1 Provide adequate nuisance dust protection masks and ear protection to operator.
.2 Wet cutting only will be permitted unless directed otherwise by Departmental Representative.
- 1.4 PROTECTION .1 Protect surrounding surfaces from damage due to work of this section. Make good such damage to satisfaction of Departmental Representative and at no additional cost.
- 1.5 CONCRETE CUTTING .1 Contractor to cut concrete, as required, to meet the intent of the contract documents.
- 1.6 CONTRACTOR'S RESPONSIBILITIES .1 Furnish labour and facilities to:
.1 Provide access to work requiring cutting.
.2 Make good work distributed by cutting.
.3 Provide storage on site for cutting specialists equipment and tools.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Concrete cutting saw to CAN/CSA-C22.2 No 71.1-M89 - Portable Electric Tools.

PART 3 - EXECUTION

- 3.1 PREPARATION .1 Define exactly, all lines to be cut or cored and mark with indelible marker or paint. All quantities and thicknesses to be reviewed with Departmental Representative and provided to Departmental Representative in writing.

- .2 Advise Departmental Representative prior to commencing cutting.
- .3 Departmental Representative to approve areas, quantities, and thicknesses identified prior to any cutting.

3.2 CUTTING, GENERAL

- .1 Sawcut to depth required using a purpose made blade in a specialized concrete saw. Depth to be a minimum of 15 mm with a 15-degree undercut to avoid feather edging.
- .2 Sawed surfaces to be smooth, plane and parallel unless otherwise specified.
- .3 Remove all debris and clean surfaces of loose material.
- .4 Remove all concrete dust and debris resulting from work specified and dispose of off National Parks property at approved dumpsite.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 02 83 10 - Lead-Based Paint Abatement: Minimum Precautions
 - .2 Section 03 20 00 - Concrete Reinforcing
 - .3 Section 03 30 00 - Cast-in-Place Concrete
 - .4 Section 07 92 00 - Joint Sealants
- 1.2 REFERENCES
- .1 Canadian Standards Association (CSA International):
 - .1 CSA A23.1-14 / A23.2-14, Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard Practices for Concrete.
 - .2 CSA O86 S1-05, Supplement No. 1 to CAN/CSA O86-01, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CSA O325-16, Construction Sheathing.
 - .7 CSA O437 Series-93 (R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-16, Falsework for Construction Purposes.
 - .9 CSA S269.3-M92 (R2013), Concrete Formwork, National Standard of Canada.
 - .2 Underwriters' Laboratories of Canada (ULC):
 - .1 ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 OPSS 919 - Construction Specification for Formwork and Falsework
- 1.3 SUBMITTALS
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by Professional Engineer registered or Licensed in the Province of Ontario, Canada.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 83 10 - Lead-Based Paint Abatement: Minimum Precautions.
 - .4 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
-

- .5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangements of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .6 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .7 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.
- .8 When slip forming is used, submit details of equipment and procedures for review by Departmental Representative.
- .9 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in the Province of Ontario.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle and store formwork materials to prevent weathering, warping or damage detrimental to the strength of the materials or to the surface to be formed.
- .2 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Ensure that formwork surfaces which will be in contact with concrete are not contaminated by foreign matter. Handle and erect the fabricated formwork so as to prevent damage.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 47 19 - Waste Management and Disposal.

- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert wood materials from landfill to a recycling facility as approved by Departmental Representative.
- .4 Divert plastic materials from landfill to a recycling facility as approved by Departmental Representative.
- .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
- .3 Formwork Materials:
 - .1 Use wood and wood product formwork materials to CSA-A23.1/A23.2 and CSA O121.
 - .2 Plywood and wood formwork materials to CSA-O121, CAN3-086.1, CAN3-086.1S1, CSA O153.
 - .3 Use new and undamaged forms only for exposed surfaces. Use formwork liners as required to achieve stringent specified finish tolerances.
- .4 Falsework materials to CAN/CSA S269.1.
- .5 Form Ties:
 - .1 Use removable or snap-off galvanized metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface. Holes are to be filled with non-shrink grout.
 - .2 Adjustable in lengths to permit tightening and alignment of forms.
- .6 Form release agent: non-toxic, biodegradable, low VOC, chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.
- .7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm² /sat 40°C, flashpoint minimum 150°C, open cup. Agent shall be compatible with bridge sealing and waterproofing systems where applicable.
- .8 Sealant: to Section 07 92 00 - Joint Sealants.

PART 3 - EXECUTION

3.1 FABRICATION AND
ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms or framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .8 Align form joints and make watertight. Keep form joints to minimum.
- .9 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Clean formwork in accordance with CSA A23.1 / A23.2, before placing concrete.
- .13 Assemble formwork so that concrete is not damaged during its removal.
- .14 Provide form finishes as per CAN/CSA A23.1 and ACI 301 as follows:
 - .1 Top of footings: rough form finish to CSA A23.1.
 - .2 Abutment walls exposed to view plus 500mm below ground surface: Rubbed finish to ACI 301.
 - .3 Deck soffits, curb faces and all other formed concrete surfaces unless otherwise indicated: Rubbed Finish to ACI 301.
 - .4 Horizontal surface at top of Sidewalk: Broom Finish to CSA A23.1.

- .5 Repair all deficient areas prior to proceeding with other finishes.
 - .15 Provide site drainage to prevent washout of soil supporting mud sills and shores.
 - .16 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
 - .17 Prior to placing concrete, the elevations of forms shall be checked to verify drainage slopes.
 - .18 Provide 48 hours notice to Departmental Representative for inspection prior to concrete placement.
 - .19 Clean formwork as erection proceeds, to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water to remove remaining foreign matters. Ensure that water and debris drain to exterior through clean-out ports.
 - .20 During cold weather, remove ice and snow from within forms, do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure.
 - .21 Patch all form tie holes and finish surface to remove all evidence of tie holes and/or patching.
 - .22 Construction Joints:
 - .1 Form construction joints where required and as approved.
 - .2 Build waterstops into forms, supported against displacement by pouring of concrete.
 - .3 Use preformed waterstop corners and intersections where they are available to suit conditions.
 - .4 Join waterstops to preformed corners and intersections, and between lengths with butted and welded connections in accordance with manufacturer's recommendations.
 - .23 Apply form release agent to all formed surfaces prior to placing concrete.
- 3.2 REMOVAL AND RESHORING
- .1 Notify Departmental Representative prior to form removal.
 - .2 Form removal times are dependent on proper curing as specified herein.
-

- .3 Remove formwork progressively and in accordance with the reference code requirements, and so that no shock loads or imbalanced loads are imposed on the structure.
- .4 Leave formwork in place for following minimum periods of time after placing concrete.
 1. 3 days for footings, retaining walls and bridge abutment walls.
- .5 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.
- .7 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.
- .8 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction, as required.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 03 10 00 - Concrete Forming and Accessories.
 - .2 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 REFERENCES
- .1 Canadian Standards Association (CSA International):
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
 - .2 CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-13 (R2014), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .7 CSA-G30.3 - Cold Drawn Steel Wire for Concrete Reinforcement.
 - .2 Reinforcing Steel Institute of Canada (RSIC):
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.
 - .3 American Society for Testing and Materials (ASTM):
 - .1 ASTM A 143/A 143M-07(2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A 641/A 641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .3 ASTM A 1064/A 1064M-16b, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .4 American Concrete Institute (ACI):
 - .1 SP-66-04, ACI Detailing Manual 2004.
- 1.4 ADMINISTRATIVE REQUIREMENTS
- .1 Pre-installation Meetings: in accordance with Section 01 31 19 - Project Meetings, convene pre-installation meeting minimum three weeks prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Departmental Representative, specialty contractor - finishing, forming, concrete producer, and testing laboratories attend.
 - .1 Verify project requirements.
-

-
- 1.5 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
 - .2 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .3 Detail lap lengths and bar development lengths to CAN/CSA-A23.3 unless otherwise indicated.
 - .1 Provide type B tension lap splices unless otherwise indicated
 - .4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.
 - .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
-

- .5 Quality Assurance Submittals:
 - .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Mill Test Report: Upon request, submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
 - .3 Upon request, submit in writing to Departmental Representative proposed source of reinforcement material.

1.6 DELIVERY, STORAGE
AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400W deformed bars to CSA G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A1060 / A1060M, minimum 30% recycled content.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A1060/A1060M, minimum 30% recycled content.
- .5 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .6 Mechanical splices: subject to approval of Departmental Representative.
- .7 Plain round bars: to CSA G40.20/G40.21.

- .8 Bending: Field bending of reinforcing bars shall only be permitted upon prior written approval from Departmental Representative. Reinforcing steel shall only be bent on equipment assigned solely for this purpose.
- .9 Handling and Storage: Reinforcing bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in bundles. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles.
- .10 Bar Supports and Spacers: Bar chairs for supporting reinforcing bars shall be non-metallic. Concrete chairs shall not be used to support steel reinforcing bars.
- .11 Lapped Splices: Where a lap splice bar is to be used to connect reinforcing bars, the lap splice bar shall be reinforcing steel of same type.
- .12 Welded Splices: Welding of reinforcing bars is not permitted.
- .13 Mechanical Coupler Splices: Subject to approval of Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ANSI/ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. Shop fabricate and bend all reinforcing steel.
 - .1 SP-66 unless indicated otherwise.
- .2 Fabricate to the following tolerances:
 - .1 Sheared length: +25mm.
 - .2 Stirrups, items and spirals: +10mm.
 - .3 Other bends: +25mm.
- .3 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 3 weeks prior to beginning reinforcing work. Mill certificates shall be in accordance with CAN/CSA G30.18.
- .2 Upon request, inform Departmental Representative of proposed source of material to be supplied.

- 2.4 CLEANING .1 Clean reinforcing to CSA-A23.1/A23.2. All reinforcing bars are to be free of scale rust and contamination at time of placing in forms.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Examine work related to this section and report discrepancies to Departmental Representative.
.2 Commencement of work shall imply acceptance of conditions.

- 3.2 FIELD BENDING .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
.2 When field bending is authorized, bend without heat, applying slow and steady pressure.
.3 Replace bars, which develop cracks or splits.

- 3.3 PLACING REINFORCEMENT .1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.
.2 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1/A23.2.
.3 Use plain round bars as slip dowels in concrete.
.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
.2 Apply thick even film of mineral lubricating grease when paint is dry.
.4 Provide all chairs, braces, lateral support, headers, ties, etc. to secure reinforcing in place during construction.
.5 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
.6 Maintain cover to reinforcement during concrete pour.
.7 Under no circumstances will concrete trucks or highway traffic be permitted to travel over the reinforcing during concrete placing operations.
.8 After reinforcing is placed and prior to closing of forms, notify the Departmental Representative for inspection of the Work.

- .9 Reinforcement shall be adequately supported by chairs, spacers or hangers and secured against displacement within the tolerance permitted and in accordance with the latest CSA A23.1/A23.2.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Reinforcing steel and welded wire fabric.
- .2 Inspection and testing of reinforcing and reinforcing materials carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory certified to CSA A283.
- .3 Ensure test results distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Inspection or testing by Consultant not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.

3.5 STORAGE

- .1 Store reinforcing steel to prevent deterioration, contamination or disfigurement.
- .2 Store reinforcing steel off the ground.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

International):

- .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
- .2 CSA A283-06-R2016, Qualification Code for Concrete Testing Laboratories
- .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
- .5 PCA Environmental Standards and Guidelines Document (2017)
- .6 Ontario Provincial Standards,
<http://www.ops.on.ca/>
 - .1 OPSS.PROV 904 Construction Specifications for Concrete Structures
 - .2 OPSS.PROV 905 Construction Specification for Steel Reinforcement for Concrete
 - .3 OPSS.PROV 920 Construction Specification for Deck Joint Assemblies, Preformed Seals, Joint Fillers, Joint Seals, Joint Sealing Compounds and Waterstops - Structures
 - .4 OPSS.PROV 1301 Material Specification for Cementing Materials
 - .5 OPSS PROV 1308 Material Specification for Joint Filler in Concrete
 - .6 OPSS.PROV 1350 Material Specification for Concrete - Materials and Production
 - .7 All references to the Contract Administrator shall be understood to mean the Departmental Representative.

1.3 ABBREVIATIONS AND ACRONYMS

- .1 Limestone Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
 - .2 Type MS and MSb - Moderate sulphate-resistant cement.
 - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 Type HE, HEb and HEL - High early-strength cement.
 - .5 Type LH, LHb and LHL - Low heat of hydration cement.
 - .6 Type HS and HSb - High sulphate-resistant cement.
- .2 Fly Ash:
 - .1 Type F - with CaO content less than 8%.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
 - .3 Type CH - with CaO greater than 20%.

- .3 GGBFS - Ground, granulated blast-furnace slag.
 - .4 SF - Silica fume with high silicon dioxide (SiO₂) content.
 - .5 N - Natural pozzolans.
- 1.4 ADMINISTRATIVE REQUIREMENTS
- .1 Pre-installation Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedule: Bar Chart (GANTT), convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming, concrete producer, testing laboratories attend.
 - .1 Verify project requirements.
- 1.5 SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide mix designs for each class of concrete to be used for review by Departmental Representative. Do not place concrete until written approval of mix design has been obtained.
 - .1 Along with the mix designs, provide product data sheets and WHMIS sheets for any chemical admixtures to be used in the concrete.
 - .3 Provide testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
 - .4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
 - .5 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
 - .6 Provide two copies of WHMIS MSDS in accordance with Section 0 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
-

- 1.6 QUALITY ASSURANCE
- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
 - .2 Provide Departmental Representative, minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
 - .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
 - .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- 1.7 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative, laboratory representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
 - .2 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 DESIGN CRITERIA
- .1 Alternative 1 - Performance: to CSA

A23.1/A23.2 and OPSS 1350, and as described in MIXES of PART 2 - PRODUCTS.

- 2.2 PERFORMANCE CRITERIA .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
- 2.3 MATERIALS .1 Portland Cement: to OPSS 1350 and CSA A3001, Type GU to CSA A23.1/A23.2 and CAN/CSA A5.
- .2 Hydraulic cement: Type GUb to CSA A3001 and OPSS 1350.
- .3 Water: to CSA A23.1 and OPSS 1350.
- .4 Aggregates: to CSA A23.1/A23.2 and OPSS 1350. Coarse aggregates to be normal density.
- .1 Aggregates to be tested for alkali-aggregate reactivity in accordance with CSA A23.1. Test result is not to exceed 0.15% at 14 days for an acceptable aggregate.
- .5 Admixtures: to be in accordance with OPSS 1350 and as follows
- .1 Air entraining admixture: to CSA A23.1/A23.2 and CAN3-A266.1.
- .2 Chemical admixture: to CSA A23.1/A23.2 and CAN3-A266.4. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .3 Obtain authorization from Departmental Representative for use of super plasticizing admixture, water reducer, and/or other admixtures as approved by Departmental Representative to achieve designed concrete properties.
- .6 Concrete shall be normal in accordance with CSA A23.1 and shall have a unit weight of 2350 kg/m³.
- .7 Curing compound: to CSA A23.1/A23.2 white and ASTM C 309.
- .8 Premoulded joint fillers:
- .1 Bituminous impregnated fiber board: to ASTM D 1751.
- .2 Sponge rubber: to ASTM D 1752, Type I, flexible firm grade.
- .3 Self-expanding Standard cork: to ASTM D 1752, Type III.
-

- .9 Weep hole tubes: plastic.
 - .10 Polyethylene film: 100 microns thickness to CAN/CGSB-51.34.
 - .11 This item includes but is not limited to supply and installation of anchor bolts, nuts and washers, bolt grouting, deck drainage, formwork, placing, compacting, and finishing, of all concrete for cast-in-place concrete on the Contract Documents to complete the project.
- 2.4 MIXES
- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria and to CSA A23.1/A23.2.
 - .2 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .1 Provide concrete mix to meet following plastic state requirements:
 - .1 Uniformity: to CSA A23.1.
 - .1 Workability: able to be placed and consolidated to completely fill the forms without unacceptable surface blemishes, loss of mortar, colour variations, segregation, etc.
 - .2 Finishability: Limitation on the acceptable amount of bleeding.
 - .3 Set time: 2 hours maximum.
 - .2 Mix 1: Non-bridge footings, retaining walls, baffle drain and reinforced concrete not on bridge:
 - .1 Exposure Classification: C-1.
 - .2 Compressive strength at 28 age: 35 MPa minimum.
 - .3 Aggregate size 20 mm maximum.
 - .3 Mix 2: Mud slabs and lean concrete:
 - .1 Compressive strength at 28 days: 10 MPa minimum.
 - .2 Exposure classification: N.
 - .4 Mix 3: Concrete for bridge deck, abutments, bridge deck curbs, sidewalks, wingwalls and other cast-in-place elements for bridge.
 - .1 Exposure Classification: C-1, except as modified below.
 - .2 Minimum comprehensive strength at 28 days: 35 MPa.
 - .3 Chemical admixtures: in accordance with ASTM C494; submit to Departmental Representative for

- approval.
- .4 Nominal maximum aggregate size: 20mm
- .5 Maximum Water/Cement Ratio: 0.40
- .6 Total cementitious materials content: minimum 415 kg/m³, maximum 480kg/m³
- .7 Air content: minimum 3% as per OPSS 1350
- .8 Slump: design for 60mm before addition of superplasticizer/Tolerances per CAN/CSA A23.1.
- .9 Maximum spacing factor for hardened concrete: 0.23mm to ASTM C457M.
- .10 Maximum chloride ion penetrability: less than or equal to 1000 coulombs within 32 days.
- .5 Use superplasticizer in all concrete to achieve workability. Pay for all admixtures as required to achieve specified properties.
- .6 Maximum concrete temperature delivered: 25 degrees Celsius, except 18 degrees Celsius where thickness of element exceeds 2 meters.
- .7 Maximum concrete temperature in situ: 70 degrees Celsius.
- .8 Maximum temperature gradient: 20 degrees Celsius per meter.
- .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 48 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.

- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Unless otherwise shown on the drawings, place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout, in accordance with manufacturer's installation documentation, to anchor and hold dowels in positions, as indicated.
- .11 All existing concrete surface shall be well dampened and free of ponding water prior to the placement of new concrete.
- .12 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION /
APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and Inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from

- Departmental Representative before placing of concrete.
- .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor Bolts:
- .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete. Pay particular attention to co-ordination with the setting, tolerances, and commissioning requirements of the works and with the Contractor's Co-ordination Plan.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with approved epoxy grouting system.
 - .5 Epoxy anchorage systems shall be in strict accordance with the manufacturer's installation guidelines.
 - .6 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage Holes and Weep Holes:
- .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Finishing and Curing:
- .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: brushed on exposed pad footings. Provide written declaration that compounds used are compatible.
 - .4 Refer to Section 03 10 00 - Concrete Forming and Accessories for form finish
-

- tolerances.
- .5 Horizontal surface at top of Sidewalk and approach slabs: Broom finish to CSA A23.1.
 - .6 Top surfaces of curbs and barriers: steel troweled finish to finish classification D per CAN CSA A23.1.
 - .7 Bridge deck: finish in accordance with OPSS 904.07.07 for bridge decks where the concrete forms the wearing surface, the wearing surface shall be textured in accordance with 904.07.07.
- .6 Joint Fillers:
- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Install joint filler.
- .7 Waterstops:
- .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
- .8 Dowel Holes and Supply and Placement of Grout:
- .1 Dowel holes shall be drilled in the existing concrete at the locations and to the minimum depths indicated on the Drawings.
 - .2 Existing embedded reinforcement, including main bars and cross-ties, shall be located prior to drilling. Unused holes shall be grouted.
 - .3 In cases where specified hole location(s) interferes with existing or new embedded reinforcement, the location(s) may be displaced from those shown on the Drawings by up to 50 mm in any direction, provided that specified minimum clear cover is maintained. Where such
-

adjustments are required, the Contractor shall inform the Departmental Representative, who will determine the new hole location(s).

- .4 Holes shall be cleaned by blowing clean with compressed air, brushing the hole, and blowing again.
- .5 All permanent and abandoned holes for dowels shall be filled with grout as shown on the drawings and acceptable to the Departmental Representative. Grout shall be placed according to the manufacturer's specifications.
- .6 All bars grouted into existing concrete with epoxy grout as called for on the drawings to the manufacturer's recommendations.
- .7 Dowels shall be installed to the full specified embedment length and in a manner that ensures complete bonding within the hole. Manufacturer's specifications and recommendations for application and installation shall be strictly adhered to.
- .8 After bonding, dowels shall be temporarily supported, as necessary, to prevent their movement during entire curing period as specified by the manufacturer. The dowels shall remain undisturbed and no load shall be placed on the dowels until the curing is complete.

- .9 Dowel in concrete and pull test:
 - .1 dowels in concrete and pull test criteria shall be in accordance with OPSS SSP 999F29 Dowels in concrete, Construction specification for the installation of metallic dowels into concrete.

3.3 ABRASIVE BLAST
CLEANING OF CONCRETE
SURFACE AND REINFORCING
STEEL

- .1 Areas and components not designated for abrasive blast cleaning shall be protected from adjacent abrasive blast cleaning operations.
- .2 The abrasive blast cleaning shall expose the coarse aggregate and remove all dirt, laitance and hardened concrete slurry. Any oil and grease on the surface of the concrete shall be removed using hand tools.
- .3 Where called for on the Drawings, surfaces of existing concrete that will be in contact with new concrete or grout shall be roughened by high pressure water blasting or by other suitable means. The outer layer of cement and

fine aggregate shall be removed, exposing coarse aggregate particles. The amplitude of roughness of the resulting surface shall be at least 5 mm. The means used to roughen the existing concrete surface shall be subject to approval by the Departmental Representative.

- .4 The full circumference of the existing reinforcing steel shall be abrasive blast cleaned to a commercial blast cleaned finish in conformance with SSPC-SP6. Commercial blast cleaning acceptance of the surface preparation will be based on the applicable SSPC surface preparation specification and visual standards given in SSPC-Vis 1, Visual Standard for Abrasive Blast Cleaned Steel.
- .5 When silica sand is used as the abrasive material the subsequent treatment of placement of concrete shall be done within 72 hours or the reinforcing steel shall be re-blasted.
- .6 When other types of abrasive materials is used the subsequent treatment of placement of concrete shall be done within 36 hours or the reinforcing steel shall be re-blasted.
- .7 Abrasive materials shall be contained and be prevented from entering into the surrounding environment.

3.4 WINTER PROTECTION

- .1 Supply, install, maintain and remove from site protective measures in order to allow for the installation of concrete during the cold weather (this includes but is not limited to all potential hoarding, pre-heating, winter heating, etc. required).
- .2 Contractor to carry out all work as outlined in Ontario Provincial Standard Specification OPSS PROV 904 November 2014.

3.5 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method.

3.6 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete Pours.
 - .2 Slump.
 - .3 Air Content.
 - .4 Compressive Strength at 3, 7, 28 and 56 days.
 - .5 Air and concrete temperature.
 - .6 Weather.

- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
 - .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
 - .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
 - .6 For compressive strength testing, a minimum of 3 cylinders and 2 field cured cylinders are required for:
 - .1 Each day's pour.
 - .2 Each type of grade of concrete.
 - .3 Each change of supplier.
 - .4 Each 40 cubic metres, or fraction thereof, for footings and foundation walls.
 - .5 Additional test specimens shall be taken whenever requested by the Departmental Representative to verify the concrete quality.
 - .7 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
 - .8 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- 3.7 CLEANING
- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
-

- .2 Provide appropriate area on job site where concrete trucks and be safely washed.
- .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
- .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
- .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

3.8 CURING

- .1 Ensure that freshly placed concrete is protected from freezing, dehydration, mechanical shock and contact with injurious substances.
- .2 Do not use curing compounds that would have a detrimental effect on bonding, adhesion, curing, appearance, or similar qualities of materials applied to concrete surfaces. Use only moisture curing.
- .3 Protect the concrete from premature drying and extremes of temperature.
- .4 Cure, protect and finish concrete to CAN/CSA A23.1, CSA S269.1 and S269.3. Curing type in accordance with specified exposure classification unless more stringent requirements are noted otherwise. Special curing and finishing requirements are as follows:
 - .1 Exterior concrete pads: curing "TYPE 2". Seven (7) days total at >10°C and for the time necessary to attain 70% of the specified concrete strength.
 - .2 Bridge Deck: Curing "TYPE 3 - Extended wet curing". A wet curing period of 7 days at >10°C. The curing types allowed are ponding, continuous sprinkling, absorptive mat, or fabric kept continuously wet.
- .5 Foot traffic shall be kept off curing concrete

- for 1 day.
- .6 Vehicles shall be kept off concrete for 7 days.
- 3.9 DEFECTIVE WORK
- .1 Repairs and classification of unacceptable concrete to be in accordance with CSA-A23.1/A23.2.
- .2 Remove defective concrete and embedded debris and repair as directed by Departmental Representative.
- .3 Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.
- .4 Remove to bare concrete curing compounds detrimental to application of specified finishes.
- .5 Concrete to be supplied at the minimum strength requirement at 28 days. Tests indicating strengths lower than specified will necessitate further testing as required by the Departmental Representative. Cost for such testing to be at the Contractor's expense. Should further tests confirm low values, the Departmental Representative has the right to require strengthening of the affected area or removal and replacing of the weak concrete all to the Contractor's expense.
- .6 Repair all shrinkage cracks in the completed concrete work employing a suitable epoxy injection technique acceptable to Departmental Representative to completely seal all such cracks.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 03 10 00 - Concrete Forming and Accessories
 - .2 Section 03 20 00 - Concrete Reinforcing
 - .3 Section 03 30 00 - Cast-In-Place Concrete
 - .4 Section 07 92 00 - Joint Sealants
- 1.2 REFERENCES
- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C 309-03, Liquid Membrane-Forming Compounds for Curing Concrete
 - .2 Canadian Standards Association (CSA International):
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
- 1.3 SUBMITTALS
- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete treatment materials. Indicate VOC content in g/L.
 - .3 Include application instructions for concrete treatment.
- 1.4 QUALITY ASSURANCE
- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
 - .2 Minimum 2 weeks prior to starting concrete finishing work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Hardening.
 - .2 Sealing.
 - .3 Curing.
 - .4 Finishes.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- .4 Construction Waste Management: Divert 50% From Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SITE CONDITIONS

- .1 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above concrete surface, for each 40 sq m of concrete being treated.
- .2 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area: Make work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature: Maintain minimum 10 degrees C ambient temperature for 7 days before installation and minimum 48 hours after completion of work and maintain relative humidity maximum 40% during same period.
- .5 Moisture: Ensure concrete substrate within moisture limits prescribed by manufacturer.
- .6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

PART 2 - PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.

2.2 PERFORMANCE REQUIREMENTS

- .1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Submit written declaration of components used compatible and not adversely affect finished products and their installation adhesives.

2.3 CHEMICAL HARDENERS

- .1 Type 1 - Sodium silicate.
- .2 Water: potable.

2.4 SEALING COMPOUNDS

- .1 Surface sealer: acrylic carnuba wax.

- .2 Surface sealers shall not contain aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium and their compounds.
 - .3 VOC limit: maximum 100g/L to SCAQMD Rule 1113
Sealants: maximum VOC limit 250g/L to SCAQMD Rule 1168.
- 2.5 CURING COMPOUNDS
- .1 Waterborne membrane forming curing membrane to ASTM C 309, Type 1 Clear Class B.
 - .1 Verify compatibility with subsequent finishes.
- 2.6 CONCRETE STAINS
- .1 Select low VOC, water-based concrete stains.
- 2.7 MIXES
- .1 Mixing ratios in accordance with manufacturer's written instructions.
- PART 3 - EXECUTION
- 3.1 EXAMINATION
- .1 Verify site conditions surfaces prior to commencing work and elevations as indicated on drawings.
- 3.2 CONCRETE STAINING
- .1 Coordinate with Section 03 30 00 - Cast-In-Place Concrete for wet curing. Liquid curing compounds not permitted under staining.
 - .2 Cure concrete for minimum 60 days.
 - .3 Clean and prepare concrete in accordance with manufacturers written instructions.
 - .4 Apply 2 coats of chemical stain materials in accordance with manufacturers written instructions; obtain Departmental Representative's acceptance after application of both first and second coats.
 - .5 Apply recommended cure/seal materials in accordance with manufacturer's written instructions, in number of coats to achieve flat lustre.
- 3.3 APPLICATION
- .1 Apply concrete finishing hardener in accordance with manufacturer's written instructions.
 - .2 After treatment dry, seal control joints and joints at junction with vertical surfaces with sealant.
 - .1 Sealant: one-part, non-sag silicone material that cures to a low-modulus rubber sealant designed for sealing joints in Portland cement concrete and accommodates typical thermal movements to the requirements specified in Section 07 92 00 - Joint Sealants.
-

- .3 Apply treatment in accordance with Sealer manufacturer's written instructions.
- .4 Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave work area clean and tidy at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for in accordance with Section 01 74 19 - Waste Management and Disposal.

3.5 PROTECTION

- .1 Protect finished installation in accordance with manufacturer's instructions.

3.6 SCHEDULE

- .1 Table:

Surface Sealer	Location
CAN/CGSB-25.20, Type 1 - water-based	Concrete Deck

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 09 91 13.23 - Exterior Painting of Structural Steel
- .2 Section 29 05 00 - Mechanical Work
- 1.2 REFERENCES .1 All work covered under this contract shall be as per the contract documents as well as all relevant Canadian and Ontario Provincial Standards unless noted otherwise in contract documents.
- All referenced standards in this section shall be current issue or latest revision at the first date of project tender advertisement.
- .2 Canadian Standards Association (CSA International):
- .1 CAN/CSA G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
- .2 CAN/CSA G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles
- .3 CAN/CSA S6-14, Canadian Highway Bridge Design Code (CHBDC)
- .4 CAN/CSA S16-14, Design of Steel Structures.
- .5 CAN/CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel
- .6 CAN/CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding
- .7 CAN/CSA W59-18, Welded Steel Construction, (Metal Arc Welding)
- .8 CAN/CSA W178.1-18, Certification of Welding Inspection Organizations
- CAN/CSA S178.2-18, Certification of Welding Inspectors
- .2 Canadian Institute of Steel Construction (CISC) Handbook of Steel Construction (R2016)
- .3 Ontario Provincial Standards, <http://www.ops.on.ca/>
- .1 OPSS 906 - Construction Specification for Structural Steel for Bridge
- .2 OPSS 911 Coating of Structural Steel
- .3 OPSS 919 Formwork and Falsework
- .4 Special Provision No. 109F16 - Transportation of Structural Components
- All references to the Contract Administrator shall be understood to mean the Departmental Representative.
- .4 American Association for State Highway and Transportation Officials (AASHTO):
- .1 AASHTO Standard Specifications for Highway Bridges-17th Edition 2002

- .5 American Society for Testing and Materials (ASTM):
 - .1 ASTM F3125/F3125M-18, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, inch and metric dimensions
 - .2 ASTM F436/F436M-18a, Standard Specification for Hardened Steel Washers Inch and Metric Dimensions
 - .3 ASTM A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - .4 ASTM A36/A36M, Standard Specification for Carbon Structural Steel

 - 1.3 ADMINISTRATIVE REQUIREMENTS
 - .1 Pre-Installation and Pre-Construction Meetings to be held as per Section 01 31 19 - Project Meetings.
 - .2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.
 - .3 Hold project meetings every week in accordance with Section 01 31 19 - Project Meetings.
 - .4 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work.

 - 1.4 ACTION AND INFORMATIONAL SUBMITTALS
 - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for structural steel and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada verifying that the details and procedures are consistent with the Contract Documents.
-

- .2 The shop details should include at least the following:
 - .1 Full detail dimensions and sizes of all component parts of the structure. These dimensions shall make allowance for changes in shape due to weld shrinkage, camber, and any other effects that cause finished dimensions to differ from initial dimensions.
 - .2 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, tapped holes, and welds.
 - .3 Erection marks.
 - .4 All necessary specifications for the materials to be used.
 - .5 Identification of areas requiring special surface treatment or finishes.
 - .6 Identification of fracture-critical and primary tension members and component parts. Attachments having a length of more than 100 mm in the direction of tension and welded to the tension zone of a fracture-critical or primary tension member shall be treated as part of that member.
 - .7 Bolt installation requirements, including number of fitting up bolts required at each connection and oversize and slotted holes.
 - .8 Details of all welds.
 - .9 Identification of material and welds requiring non-destructive testing, including the limits of the weld undergoing testing and the frequency and type of testing.
 - .10 Temporary welds.
 - .11 Location of shop and field splices.
 - .12 The fabricator shall not commence fabrication until he has received one set of shop detail drawings and welding procedures sealed and signed by an Engineer.
 - .13 The fabricator shall have a copy of the shop detail drawings and welding procedures at the manufacturing plant during fabrication.
 - .4 Submit proposed welding procedures, data-sheets, and repair procedures stamped and approved by Canadian Welding Bureau and stamped and signed by professional engineer registered or licensed in Province of Ontario, verifying that the procedures are consistent with the Contract Documents.
-

All welding procedures shall be according to CSA W47.1 and CSA W59, except where modified by CSA S6 Annex A10.1.

- .5 Submit erection diagrams and procedure drawings and calculations, description of methods, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel, and methods to verify interface elements (components, dimensions, shape, connections, splices etc.) between structural steel components and mechanical components, and dimensional control procedures, prior to commencement of erection for information purposes only.
Erection diagrams and erection procedure drawings shall include at least the following:
 - .1 Principal dimensions of the bridge.
 - .2 Erection marks.
 - .3 Sizes of all members.
 - .4 Field welding requirements, including identification of welds requiring non-destructive testing.
 - .5 Size and type of bolts.
 - .6 Bolt installation requirements, including the number of fitting up bolts required at each connection and identification of oversize and slotted holes.
 - .7 Bracing during erection of structural steel.
 - .8 Sequence of erection of structural steel.
 - .9 Treatment at faying surfaces for joints designed as slip critical.
 - .10 The Contractor shall not commence erection until he has received one set of erection diagrams and erection procedure drawings and calculations sealed and signed by an Engineer.
 - .11 The Contractor shall have a copy of the erection diagrams and the erection procedure drawings and calculations, as well as all other erection documentation at the site during erection.
- .6 Falsework drawings submitted to bear signature and stamp of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .7 Erected girder elevations and top of splice plate elevations shall be checked, recorded and submitted to the Departmental Representative.
- .8 Submit to Departmental Representative prior to fabrication, two (2) copies of steel producer certificates, in accordance with CSA G40.20/G40.21-13 (R2018).
- .9 Submit Departmental Representative two (2) copies of mill certificates for all steel and certified test

reports for Charpy V-notch tests and NDT testing. Mill Test Certificates to be provided as per OPSS 906.

- .10 Submit to Departmental Representative two (2) copies of test reports for fasteners. Test reports for fasteners shall be as per OPSS 906.
- .11 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .12 Submit to Departmental Representative two (2) copies of inspection reports. Inspection reports shall bear the seal and signature of a Professional Engineer Licensed to Practice in the Province of Ontario and be submitted to the Departmental Representative.
- .13 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
- .14 Upon completion of erection, the Contractor shall submit to the Departmental Representative a Certificate of Conformance sealed and signed by a Quality Verification Engineer. The Certificate shall state that the Work has been carried out in general conformance with the signed and sealed shop details, welding procedures, erection diagrams, erection procedure drawings, and Contract Documents and issue the fabricator written permission to proceed with work.

1.5 DELIVERY,
STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements and with manufacturers written instructions.
- .2 Transportation of structural components shall be in accordance with the Highway Traffic Act (HTA) and OPSS Special Provision No 109F16.
 - .1 The reduced load period is: Southern Ontario, March 1 to April 30
 - .2 For category (C) load, the designer of the load is responsible for obtaining transportation approvals from the Weight and Load Engineer, Carrier Safety and Enforcement Branch, MTO and other authorities. Road transportation approval for category (C) loads will require detailed transportation evaluation. This evaluation shall include alternate mode of transportation

by rail or marine, impact on highway safety, carrying vehicle, and structure adequacy en route etc. Designer should include all approval documents in an appendix to this SP. The approval document(s) should include overall vehicle weight and dimensions, travel route(s), travel conditions required by MTO and other authorities, and carrying vehicle(s) description. Where a Traffic Management Plan Report has been prepared, the approval documents should state that this report may be viewed for information purposes, at the MTO Contract Tendering Section, St. Catharines and/or Regional Office, during office hours.

- .3 Provide Departmental Representative with delivery schedules minimum 7 days prior to shipping.
- .4 Contractor shall perform all work necessary to ensure safe loading, delivery, unloading and storage of structural steel, including temporary works for access.
- .5 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. Advertising by means of removable signing is permitted on elements only while in transit to the specified site, painting of advertisements directly on elements is not permitted.
- .6 Storage and Handling Requirements:
 - .1 Provide protective blocking for lifting, transportation and storing.
 - .1 Exercise care during fabrication, transportation and erection so as not to damage primary structural elements.
 - .2 Do not notch edges of members.
 - .3 When the components are stored on the job site, they shall be placed on timbers so that they do not make contact with the ground and are supported to avoid fatigue cracking, deformation, damage or over-stressing.
 - .4 Structural steel shall be stockpiled to avoid excessive stress deformation or other damage while stored
 - .5 Provide lifting and transportation plans for larger items.
 - .6 Temporary attachments are allowed only if approved by Departmental Representative. Temporary attachments must be removed, ground flush and tested by MPI, to 100% acceptance criteria.
 - .2 Mark mass on members weighing more than 3 tonnes. Hard stamping shall not be used.

- .3 Protect unpainted steel, before erection, with waterproof covering.
- .4 Ensure that no portion of steel comes into contact with ground and where they will not be subject to damage or surface contamination.
- .5 Replace defective or damaged materials with new.
- .7 Structural steel shall be loaded for shipping in such a manner that it can be transported and unloaded at its destination without being excessively stressed, deformed, or otherwise damaged. Plate girders shall be transported with their webs in a vertical plane. When girders cannot be shipped with their webs in the vertical plane, static and dynamic forces during handling, transportation, and storage shall be determined using a dynamic load allowance of 100%. Computed stresses shall be according to CSA S6, Clause 10.10 and the maximum cyclic stress range shall not exceed the constant amplitude fatigue threshold for the appropriate fatigue categories specified in CSA S6, Table 10.4. All the calculations and associated sketches, including reasons why the girders cannot be shipped with the webs in the vertical plane, shall be submitted by the Contractor to the Departmental Representative for approval 7 Days prior to shipping. The calculations and sketches shall be signed and sealed by a Professional Engineer registered in Ontario.
- .8 Bolts, nuts and washers shall be supplied and shipped together as assemblies from the same manufacturer.
- .9 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
- .10 Packaging Waste Management: remove for reuse and return to/by manufacturer packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 QUALITY
ASSURANCE

- .1 Preconstruction Testing:
 - .1 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.
 - .2 Adequate time shall be allotted for in both the construction and fabrication schedules to allow inspectors to complete all inspections and tests required. The construction and fabrication schedules provided for review to the Departmental Representative at the start of

construction shall include an inspection and test plan which designates inspection task items that clearly show the time allotted for inspections and tests. Time shall also be allotted in the schedules for the review of all shop drawings as outlined in this section.

- .2 Visual inspection, non-destructive testing, and sampling shall be done in the fabricating shop and in the field by an Owner's inspector to confirm the material supplied, fabrication, and erection has been done as specified in the Contract Documents.
- .3 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .4 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 The Contractor shall supply electric power, scaffolding, protection from the weather, and free access for inspection and testing of material, to all aspects of the fabrication, delivery, and erection of the structural steel.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural steel: shall be new and of the grade and category as indicated in the contract documents according to CSA G40.20/G40.21.

Substitution of other material for size and grade is not permitted unless approved by the Departmental representative.
- .2 The girders, floor beams and stringers shall be considered fracture critical members as per Section 12 of CSA W59-13 and Section 10 of CSA S6-14.
- .3 All atmospheric corrosion resistant steel components shall be abrasive blast-cleaned according to SSPC-SP6/NACE No. 3 to completely remove mill scale, rust, coating, oxides, corrosion products, oil, grease, dust, dirt and other foreign matter. Or shall be prepared in accordance with coating manufacturer's written instructions.
- .4 High strength bolt assemblies to be as specified in the contract documents in accordance with the following:
 - .1 ASTM F3125M grade A325M heavy hex head Type 1 bolts complete with ASTM F436/F436M Type 1 hardened washers and ASTM A563 Grade 10S nuts unless noted otherwise in contract documents.

- .2 ASTM F3125 grade F1852 twist-off Type 1 bolts complete with ASTM F436/F436M Type 1 hardened washers and ASTM A563 Grade 10S nuts unless noted otherwise in contract documents.
- .5 Bolt assemblies of grade A325M to be hot-dip galvanized in accordance with ASTM F3125M and then coated with two coats (one mid coat and one top coat) in accordance with Section 09 91 13.23 - Exterior Painting of Structural Steel.
- .6 Bolt assemblies of grade F1852 to be mechanically deposited zinc coated in accordance with ASTM B695, Class 55 Type 1. Applied coating to be applied under manufacturer direction. Grade F1852 bolt assemblies shall not be hot-dip galvanized. Other restrictions on coatings as stipulated in ASTM 3125M shall also apply.
- .7 Lubrication condition of ASTM F1852 twist-off-type tension control bolt assemblies shall not be modified.
- .8 Welding electrodes: welding electrodes, electrodes and flux or electrodes and gas combinations shall be low hydrogen (level H16 or less) and shall be according to CSA W47.1, CSA W48 and Section 12 of CSA W59, and shall be in accordance with OPSS 906.05.03.
- .9 Non-destructive testing shall be carried out using procedures according to CSA W59.
- .10 Stud shear connectors: to CSA W59, Clause 5.5.6 and Appendix H. Only studs of Type B shall be used.
- .11 Metal coatings including thermal sprayed metal coating and hot dip galvanizing, shall be as per OPSS 911.
- .12 Workmanship and finish shall be of the best modern general practice in the bridge fabrication and construction industry. Stressing, flame cutting and planning shall be done carefully and accurately. Particular attention shall be paid to the neatness and uniformity of finish of all parts of the work exposed to view.
- .13 Paint coatings: to be as per Section 09 91 13.23 - Exterior Painting of Structural Steel.
- 2.2 SOURCE QUALITY CONTROL .1 Quality control shall be according to CSA S6 Annex A.10. The acceptance standards of CSA W59 for dynamically loaded structures shall also apply.

- .2 In addition to quality control measures instituted by the Contractor, the Contractor shall be responsible for the quality control procedures specified in this contract document.
 - .3 Steel producer qualifications: certified in accordance with CSA G40.20/G40.21.
 - .4 Provide Departmental Representative prior to fabrication, with two (2) copies of steel producer certificates, in accordance with CSA G40.20/G40.21-13 (R2018).
 - .5 For control of material a record for each component shall be kept to identify the material as to heat number, corresponding mill test certificate, and colour coding or other identifying markings.
 - .6 Submit Departmental Representative two (2) copies of mill certificates for all steel and certified test reports for Charpy V-notch tests and NDT testing. Mill Test Certificates to be provided as per OPSS 906.
 - .7 Test reports for fasteners to be provided as per OPSS 906.
 - .8 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.
 - .9 Adequate time shall be allotted for in both the construction and fabrication schedules to allow inspectors to complete all inspections and tests required. The construction and fabrication schedules provided for review to the Departmental Representative at the start of construction shall designate inspection task items that clearly show the time allotted for inspections and tests.
 - .10 All welding inspection shall be according to CSA W59 and OPSS 906.07.01.07.11 and indicated herein.
 - .11 The Contractor's inspector shall carry out full visual inspection.
 - .12 Non-destructive testing shall be as per OPSS 906.07.04.04 and as specified herein.
 - .13 Inspection reports shall bear the seal and signature of a Professional Engineer Licensed to Practice in the Province of Ontario and submitted to the Departmental Representative.
 - .14 The acceptance criteria for all welding inspections shall be based on CSA W59, Section 12, Cyclically Loaded Structures (with exception of pedestrian guardrails).
-

- .1 All welds shall be 100% visually inspected.
 - .2 All full penetration welds in flanges shall be 100% inspected by Radiographic or Ultrasonic methods. When welds are tested by the Ultrasonic method, spot Radiography shall be performed on 10% of those welds tested.
 - .3 All full penetration welds in webs shall be 100% inspected by Radiographic or Ultrasonic methods for the full weld length.
 - .4 Web-to-flange fillet welds shall be subject to magnetic particle inspection in accordance with the following:
 - .1 Submerged arc welds: 25% of length.
 - .2 Semi-automatic welds: 50% of length.
 - .3 Manual welds: 100% of length.
 - .5 Fillet welds for attaching connection plates, stiffeners to which diaphragms and cross-bracing is attached shall be 100% inspected by magnetic particle inspection for one-half the depth from the tension flange and 100% for transverse welds on tension flanges.
 - .6 Radiographic and ultrasonic testing shall be performed prior to assembly of the flanges to the webs.
 - .7 The acceptance standards for dynamically loaded structures specified in clause 12.5.4 of CSA W59 shall apply to weld defects.
 - .8 Arc strikes shall be lightly ground and checked for cracks by magnetic particle inspection.
 - .9 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.
 - .10 Fabricator shall maintain documentation of all visual and non-destructive testing for review and confirmation by the Departmental Representative. Documentation shall be submitted to the Departmental Representative upon completion of the contract.
 - .15 If weld defects are identified the welds shall be removed, re-welded and re-tested. All repairs shall be documented in accordance with CSA S6 and reported to the Departmental Representative. Welding repair procedures shall be approved by the engineer in accordance with CSA S6.
 - .16 Weld defects identified in fracture-critical and primary tension members shall be repaired as per OPSS 906.07.01.07.12.
 - .17 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
-

- .18 The cost of additional inspection and testing made necessary by the Contractor's work not meeting these specifications shall be the responsibility of the Contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for structural steel installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after inspection by Departmental Representative as required and receipt of written approval to proceed from Departmental Representative.
- .2 Work under this section includes radiographic examination of optional shop splices and additional field splices as applicable.

3.2 PREPARATION

- .1 Clean steel surfaces as directed by Departmental Representative when staining or defacing occurs.
- .2 Verify location of substructure units, elevations of bearing seats and location of anchor bolts before erection of structural steel; report discrepancies to Departmental Representative.
- .3 Work near river banks or embankments in accordance with written instructions from Departmental Representative.
- .4 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.
 - .1 Enlarge holes if necessary by reaming only after receipt of written approval from Departmental Representative.
 - .2 Ensure reamed holes are 2 mm maximum larger than nominal bolt size used.
- .5 Fabricate and install bearings as indicated in contract documents. When the contract does not contain a separate item for bearings and bearings are not paid as part of any concrete tender item according to OPSS 904, the contract price for the

erection of structural steel shall include full compensation for all labour, equipment and material to supply and install the bearings.

- .6 Also included under this item (but not limited to) is the supply of electric power, scaffolding, protection from the weather, shop drawings, steel, welding, fit-up, manufacture, supply, delivery, and installation. This item also includes temporary support and protection of structural steel as required until completion of the work and access for material testing and inspection shall be the Contractor's responsibility at no extra cost to the Owner.

3.3 INSTALLATION

- .1 Steel Fabricator and personnel must be certified to CWB Division 1. Steel Fabrication must also be certified to CISC Quality Guideline for Steel Bridges, 2010.
- .2 Falsework shall be in accordance with CSA S269.1 and OPSS 919.
- .3 All fabrication, welding and erection of structural steel shall be in accordance with CSA S6 Annex A10.1, CSA W59, OPSS 906.07.01.07 (all sections) and reviewed shop drawings. Supplemented with AASHTO Standard Specifications for Highway Bridges and the Ontario Provincial Standards where necessary.
- .4 All welded construction shall be in accordance with CSA W59 and CSA S6 Annex A10.1, except where specified otherwise.
 - .1 For CSA G40.20/G40.21, grade 350AT steel, deposited weld metal to have Charpy V-Notch value not lower than that of steel.
 - .2 Do welding in shop unless otherwise permitted by Departmental Representative.
 - .3 Weld only at locations indicated.
- .5 All bolted construction shall be in accordance with CSA S6 Annex A.10. Use 'turn-of-nut' tightening method.
- .6 Fabrication for plate edges, straightening material, and plasma arc cutting of holes to be in accordance with OPSS 906. Any required submissions or approvals are to be to the Departmental Representative.
- .7 Fabricate work square, true, free from twists, bends, open joints, sharp corners and edges, straight and accurate to required size, with joints closely fitted and properly secured.
- .8 Where possible, fit and shop assemble work, ready for erection.

- .9 All dimensional and workmanship tolerances shall be according to CSA W59 and CSA S6 Annex A.10 unless noted otherwise herein.
- .10 Allowable tolerance for bolt holes:
- .1 Matching holes for bolts to line up so that dowel 2 mm less in diameter than hole passes freely through assembled members at right angles to such members.
 - .2 Finish holes not more than 2 mm in diameter larger than diameter of bolt unless otherwise specified on design drawings or by Departmental Representative.
 - .3 Centre-to-centre distance between any two holes of group to vary by not more than 1 mm from dimensioned distance between such holes.
 - .4 Centre-to-centre distance between any two groups of holes to vary not more than maximum of the following:
- | Centre-to-Centre distance in metres | Tolerance in plus or minus millimeters |
|-------------------------------------|--|
| Less than 10 | 1 |
| 10 to 20 | 2 |
| 20 to 30 | 3 |
- .5 Correct mispunched or misdrilled members only as directed by Departmental Representative.
- .8 Span length tolerances:
- .1 Girders and beams: plus or minus 6 mm.
 - .2 Centre-to-centre of bearing stiffeners and bearing plates: plus or minus 3 mm.
 - .3 All assembled components of the bridge shall fit within the existing location of the abutments while ensuring that the gap is sufficiently large on either side of the bridge to allow expansion/contraction of the deck. The joint gap cannot be permitted to exceed 60mm at extreme movement in accordance with CSA S6-14.
- .9 Girder support requirements:
- .1 Support top and bottom flanges of ends of girders and intermediate bearing locations of continuous girders parallel to each other at 90 degrees to girder web.
 - .2 Install flat and smooth except as otherwise indicated.
 - .3 Install bearing stiffeners after girder support requirements have been met.
 - .4 Correct irregularities of flanges of girders as permitted by Departmental Representative.

- .10 Shop splices:
 - .1 Use complete joint penetration groove welds finished flush unless noted otherwise on drawings or specifications for specific elements.
 - .2 Details of butt joints to CSA W59.
 - .3 Use only as indicated on design drawings and approved by Departmental Representative.
 - .11 Cambering to be in accordance with OPSS 906.07.01.04 and the following:
 - .1 There are structural cambers to compensate for deflections as shown on the drawings. Fabricate to tolerances within standards specified. Fabricate floor beams not shown as having specified camber such that any incidental camber is crowned upwards so that no net sag towards or away from the road centerline occurs. Camber and shape tolerances for girders and beams to CSA W59.
 - .2 Record measurements of camber of each girder, at points indicated.
 - .3 Fabricate field splices to conform to required camber.
 - .4 Submit diagram to Departmental Representative showing camber for each girder fabricated.
 - .5 Advise Departmental Representative immediately when camber of fabricated girder is greater than specified tolerances.
 - .6 Submit proposal for corrective measures.
 - .7 Undertake remedial measures as approved by Departmental Representative.
 - .12 Shop erection:
 - .1 The method of erection of the steel girders is the responsibility of the Contractor. Measure and record deflection at same points indicated for measurement of camber per the contract documents.
 - .2 Measure deflections in plane of girder web.
 - .3 Submit diagram to Departmental Representative showing deflection measurements for each girder before delivery.
 - .4 Shop erection is not required for single span girders with no field splices.
 - .13 Field splices: only as indicated on the contract documents and approved by the Departmental Representative.
 - .14 Mark members in accordance with CSA G40.20/G40.21.
 - .1 Do not use die stamping.
 - .2 Place marking at locations hidden when viewed from exterior after erection when steel is to be left in unpainted condition.
 - .15 Identification marking for erection: each member shall carry an erection mark for identification.
-

Permanent marking shall be affixed in an area not exposed to view in the finished structure.

- .16 Match marking: shop mark bearing assemblies and splices.
- .17 Protect exposed concrete surfaces of substructures from staining due to weathering of unpainted steel as follows:
 - .1 Apply two coats of resin to concrete surfaces prior to erection of steel.
 - .1 Resin: quick drying clear co-polymer resin, based on methyl methacrylate formulation.
 - .2 Apply resin in accordance with manufacturer's instructions.
 - .2 Protect top surfaces of concrete with waterproof cover and drain away from vertical faces.
 - .1 Install drain pipe to ground surface to discharge water.
 - .3 Use galvanized anchors for anchorage to concrete.
 - .4 Submit details of installation and methods of support to Departmental Representative for review prior to commencing protection work.
 - .5 Repair tears or holes in protective cover immediately.
- .18 Maintain protection of concrete for 28 days after completion of steel erection.
 - .1 Remove waterproof covers and drains and holding structures when steel erection complete.
- .19 All bolts to be detailed and installed with threads excluded from shear planes.
- .20 All steel shall be coated as per Section 09 91 13.23 - Exterior Painting of Structural Steel

3.4 ERECTION

- .1 Erection shall be according to CSA S6 Annex A.10, and as noted herein.
- .2 The Contractor shall not commence erection until he has received one set of erection diagrams and erection procedure drawings and calculations sealed and signed by an Engineer.
- .3 The Departmental Representative shall be notified in writing of the starting erection date at least 14 days prior to commencement of field operations.
- .4 The fabricator shall erect the whole of the fabricated structural steel work supplied under the Contract. The Contractor shall supply all materials, tools, equipment, plans and labour necessary for the erection of the steel work. The fabricator shall

erect the structural steel in accordance with the requirements of the CSA S6 specifications with supplement from AASHTO specification.

- .5 The method of erection of the steel girders is the responsibility of the Contractor. A fully detailed Engineered Erection Design and Procedure stamped by a Professional Engineer Licensed to Practice in the Province of Ontario shall be provided by the contractor for review at least four weeks (20 business days) before the start of erection. The erection procedure shall be undertaken in accordance with CSA S6.
 - .6 Welding work to be completed in accordance with CSA W59 and CSA S6 Annex A10.1, unless specified otherwise.
 - .7 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
 - .8 Account for the stability of the new and existing foundations as well as the stability of all slopes during erection in the Engineered Erection Design. Unless proven to be acceptable, means shall be taken to avoid surcharging the new and existing foundations and slopes with cranes, equipment, temporary shallow support foundations, etc.
 - .9 Exposed fastening devices to be painted to match finish and be compatible with material through which they pass.
 - .10 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
 - .11 Infilling of the Trent-Severn Waterway to complete the bridge superstructure erection is not acceptable unless otherwise approved in writing by the Departmental Representative.
 - .12 Permissible staging/laydown areas to prepare for the girder erection are as indicated on the Contract Drawings.
 - .13 Repairs to erected material shall only be permitted after the Departmental Representative has approved the proposed repair procedure.
 - .1 Welding shall not be used to fill misplaced holes.
 - .2 Hammering that can damage or distort the members is not permitted.
 - .14 Connections shall be as per OPSS 906.07.03.03 and in accordance with CSA S6.
-

- .15 The bridge shall be erected to the alignment and elevations specified in the contract documents.
- .16 The top of flange elevations and top of splice plate elevations specified on the Contract Documents shall be checked and elevations recorded and submitted to the Departmental Representative.
- .17 All steel shall be coated as per Section 09 91 13.23 - Exterior Painting of Structural Steel. Bolt heads and damaged areas shall be coated/repaired to match bridge colour.

3.5 FIELD QUALITY
CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of steel.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Ensure manufacturer's representative is present before installation, during critical periods of installation and during testing.
 - .4 Schedule site visits:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
- .2 The supply of electric power, scaffolding, protection from the weather, and access for material testing and inspection shall be the Contractor's responsibility at no extra cost to the Owner.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave work area clean and tidy at end of each day.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 11 - Cleaning.

- .4 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .5 Management of excess material shall be according to Contract Documents.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 06 15 00 - Wood Decking
- 1.2 REFERENCE STANDARDS .1 ASTM International
- .1 ASTM A123-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .3 ASTM A480/A480M-18, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .4 ASTM A653/A653M-19, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM F 2329/F 2329M-15, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
 - .6 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings
 - .7 ASTM F3125/F3125-18, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- .2 American Wood Protection Association (AWPA)
- .1 AWPA M1-18, Standard for the Purchase of Treated Wood Products
 - .2 AWPA M2-19, Standard for the Inspection of Preservative Treated Products for Industrial Use
 - .3 AWPA M4-15, Standard for the Care of Preservative-Treated Wood Products
 - .4 AWPA P5-15, Standard for Waterborne Preservative
 - .5 AWPA P23-14, Standard for Chromated Copper Arsenate Type C (CCA-C)
- .3 CSA Group
- .1 CSA O80 Series-15, Wood Preservation.
 - .2 CSA O86-14, Engineering Design in Wood
- .4 Underwriters Laboratory of Canada (ULC)
- .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies.
-

-
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Sustainable Submittals:
 - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
 - .2 Submit certificate issued by Canadian Wood Preservation Authority (CWPCA) certifying conformity with Environment Canada Technical Recommendation Document for the Design and Operation of Wood Preservation Facilities.
 - .3 Quality assurance submittals:
 - .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 For products treated with preservative by pressure impregnation submit following information certified by authorized signing officer of treatment plant:
 - .1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.
 - .2 Moisture content after drying following treatment with water-borne preservative.
 - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.
 - .3 Recommended metal connector and fastener materials and corrosion protection.
 - .4 Product recommendation for field treatment.
- 1.4 QUALITY ASSURANCE
- .1 Plant inspection of products treated with preservative by pressure impregnation will be carried out by designated testing laboratory to AWPA M2, and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.
 - .2 Each piece of lumber and plywood for preserved wood foundations to be identified by CSA 0322 certified stamp.
 - .3 Inspection and testing will be carried out by a Testing Laboratory designated by Departmental Representative.
 - .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .5 Sustainable Requirements:
 - .1 Construction requirements: in accordance with
-

Section 01 47 15 - Sustainable Requirements:
Construction.

- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with product category, manufacturer's name and address.
 - .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Store separated reusable treated wood waste convenient to cutting station and work areas.

PART 2 - PRODUCTS

- 2.1 SUSTAINABLE REQUIREMENTS
- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
 - .2 Wood preservation plants: certified by Canadian Wood Preservation Authority (CWPCA) to Environment Canada Technical Recommendation Document for the Design and Operation of Wood Preservation Facilities.
- 2.2 PRESERVATIVE TREATED WOOD MATERIALS AND APPLICATION
- .1 Provide preservative treated lumber and plywood in accordance with CSA O80 Series standards as specified below.
 - .2 Decking, above ground, exterior:
 - .1 Use Category: 3.2
 - .2 All wood for permanent applications shall be pressure preservative treated.
 - .3 Treatment shall be waterborne type Chromated Copper Arsenate (CCA) in accordance with CSA-O80 and AWPA Standards M1, M2, M4, P5 and P23. Natural finish.
 - .12 Treat to CSA O80 Series or AWPA as applicable using Chromated Copper Arsenate (CCA) preservative to obtain minimum net retention of 4.0 kg/m³ of wood.
 - .13 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.
 - .14 Preservative treatment for clear finish: Species Douglas Fir Select Structural Grade treated to CSA-O80 Series or AWPA as applicable water-borne.
-

- 2.3 CORROSION PROTECTION FOR CONNECTORS AND FASTENERS FOR USE WITH TREATED WOOD
- .1 Connectors: Fabricated from steel sheet galvanized in accordance with ASTM A 653 to minimum G185 coating or galvanized post fabrication to ASTM A 123 Type 304/316 stainless steel sheet to ASTM A 480.
 - .2 Fasteners: Hot dip galvanized to ASTM A 153/A 153M Class C and D , ASTM F 2329/F 2329M, Type 304/316 stainless steel to ASTM A 480 or use proprietary polymer coated steel fasteners.
- 2.4 PRESERVATIVE FOR FIELD TREATMENT
- .1 Type recommended by manufacturer to suit specified pressure treated products.

PART 3 - EXECUTION

- 3.1 CONSTRUCTION
- .1 Incorporate treated wood products into construction in accordance with Section 06 15 00.
 - .2 Use connectors and fasteners with specified corrosion protection in all construction with treated wood products.
 - .3 Provide barrier membrane where indicated.
- 3.2 FIELD TREATMENT
- .1 Comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.
 - .2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of recommended preservative before installation.
 - .3 Remove chemical deposits from surfaces of treated wood to receive applied finish.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 06 05 73 - Wood Treatment
 - 1.2 REFERENCE STANDARDS .1 ASTM International
 - .1 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings
 - .2 ASTM F3125/F3125-18, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPA Minimum Tensile Strength
 - .2 CSA International
 - .1 CAN/CSA O80 Series-15, Wood Preservation
 - .2 CSA O86-14, Engineering Design in Wood
 - .3 CAN/CSA-O141:05 (R2019), Softwood Lumber
 - .4 CAN/CSA-Z809-16, Sustainable Forest Management
 - .5 CAN/CSA-G164-18, Hot dip galvanizing of irregularly shaped articles
 - .4 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001 V5-2 EN, FSC Principles and Criteria for Forest Stewardship
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
 - .6 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2017.
 - .7 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2015-2019 (extended through 2021) Standard.
 - .10 American Wood Protection Association (AWPA) Standards
 - .1 AWPA M1-18, Standard for the Purchase of Treated Wood Products
 - .2 AWPA M2-19, Standard for the Inspection of Preservative Treated Products for Industrial Use
 - .3 AWPA M4-15, Standard for the Care of Preservative-Treated Wood Products
 - .4 AWPA P5-15, Standard for Waterborne Preservative
 - .5 AWPA P23-14, Standard for Chromated Copper Arsenate Type C (CCA-C)
-

-
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood decking and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Environmental Procedures.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
 - .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 2 full length samples of each type.
 - .5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
 - .6 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and
-

- post-industrial content, and total cost of materials for project.
- .3 Regional Materials: submit evidence that project incorporates required percentage 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
 - .4 Wood Certification: submit vendor's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.
 - .5 Low-Emitting Materials (if applicable):
 - .1 Submit listing of adhesives and sealants and paints and coatings used and comply with VOC and chemical component limits or restriction requirements.
 - .2 Submit listing of composite wood products used, stating that they contain no added urea-formaldehyde resins.
- 1.4 QUALITY ASSURANCE
- .1 The quality of all materials and finished products shall be subject to inspection and approval by the Departmental Representative. The manufacturer shall afford the Departmental Representative all reasonable facilities and access to ensure that the wood products furnished are according this this specification.
 - .2 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board or independent grading agency according to CAN/CSA O141.
 - .1 When the grade stamp is obscured or is nonexistent, the following certificate shall be provided by the fabricator:
 - .1 Verification of compliance with grade and species by an agency approved by the Canadian Lumber Standards Accreditation Board (CLSAB).
 - .3 Sustainable Standards Certification:
 - .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.
 - .4 Marking of wood for identification of preservative treatment: All wood with preservative treatment shall be marked using a certification mark authorized by the Canadian Wood Preservers Bureau (CWPB).
-

- .1 When the certification mark is obscured or is nonexistent, a certificate shall be provided by the fabricator verifying that the material was treated at a plant authorized by the CWPB.
- 1.5 DELIVERY,
STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Wood shall be kept free of dirt and stored off of the ground in a location that will not create an excessive increase in temperature through the greenhouse effect resulting in rapid drying of the material. Wood shall be stored in a manner that will prevent ponding or trapping of excess moisture between surfaces.
- .2 Store and protect wood decking from nicks, scratches, and blemishes. Repair of cuts, abrasions, and holes in material treated with water-borne preservatives shall be according to CSA O80 series.
- .3 Chains, hooks, or peaves shall not be used in handling treated wood. Surfaces exposed by field cutting or drilling shall be treated by soaking with an approved preservative equal in toxicity to the original preservative according to CSA O80 series. Three applications are required, each to air dried surface condition.
- .4 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return to vendors pallets, crates, padding, and packaging materials as specified in the Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Wood decking: to NLGA standard Grading Rules for Canadian Lumber select structural grade Douglas Fir. Kiln dry decking to 19% maximum moisture content.
 - .1 CAN/CSA-Z809 or FSC or SFI certified.
 - .2 All wood in permanent structures shall be new and shall be according to the grade, species, size and surface finish as specified in the contract documents. All sized of sawn wood shall be dressed sizes.
- .2 Decking lengths: Shall be full length as shown in Contract Documents. Square ends trimmed.
- .3 Tolerances:
 - .1 Dimensions: Dressed cross sectional dimensions to be within ± 2 mm. Length to be within ± 10 mm.
 - .2 Splits and Checks: The width of splits and checks at the surface shall not exceed 6 mm. Splits shall not exceed in length any of the following: twice the member thickness; one and one half times the member width; nor one quarter the member length.
- .4 Bolts: to ASTM F3125 grade 325M, hot dipped galvanized finish.
- .5 Wood preservative: all wood for permanent applications shall be pressure preservative treated. Treatment shall be waterborne type Chromated Copper Arsenate (CCA) in accordance with CSA-O80 and AWPA Standards M1, M2, M4, P5 and P23. Natural finish. All wood treatment to be as per Section 06 05 73 - Wood Treatment.

PART 3 - EXECUTION

.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood decking installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written

approval to proceed from Departmental Representative.

- 3.2 INSTALLATION
- .1 Do wood deck work to CSA O86 except where specified otherwise.
 - .2 Install decking to Contract Documents.
 - .3 Supply minimum bearing support for each plank as shown on Contract Documents.
 - .4 End joints shall be as shown on Contract Documents.
 - .5 Apply preservative to end cuts of pressure treated lumber.
- 3.3 QUALITY CONTROL
- .1 Field Testing:
 - .1 Testing moisture content of delivered material will be performed by testing laboratory designated by Departmental Representative.
 - .2 Departmental Representative will pay for costs of testing in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
 - .3 Testing moisture content of delivered material will be by testing laboratory designated by Departmental Representative by moisture meter with adjustments for species and temperature.
 - .2 Wood preservative:
 - .1 The wood preserving plant shall use quality control procedures according to CSA O80 Series.
- 3.4 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
-

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by wood decking installation.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 03 30 00 - Cast-in-Place Concrete
 - .2 Section 32 12 16.01 - Asphalt Paving
 - .3 Section 32 12 13.16 - Asphalt Tack Coat
- 1.2 REFERENCES
- .1 Canadian General Standards Board (CGSB):
 - .1 CGSB 37-GP-9Mp-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing
 - .2 CGSB-37.50-M89, Hot Applied Rubberized Asphalt for Roofing and Waterproofing
 - .3 CGSB-37.51-M90, Application for Hot Applied Rubberized Asphalt for Roofing and Waterproofing
- 1.3 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Latest edition of Manufacturer's literature including performance data and installation procedures.
 - .3 A sample of the waterproofing membrane shall be tested and approved prior to incorporation into the Work.
 - .4 Submit test results for the Water Absorption Test of the protection board one week prior to installation.
 - .5 The Contractor shall give a minimum of 48 hour notice, in writing, prior to commencement of any waterproofing operations.
 - .6 Copy of Applicator's certification issued by the manufacturer stating that the Applicator is a qualified installer of the manufacturer's system.
- 1.4 QUALITY ASSURANCE
- .1 Protection Board: protection board shall be tested using the Water Absorption Test. Two specimens of protection board 150 mm x 50 mm shall be cut. The specimens shall be over dried to constant mass at 60 C +/- 1 C. The mass of the specimens before and after drying shall be recorded.
 - .2 The specimens shall then be submerged horizontally under 25 mm of water three times as follows:
 - .1 First immersion: the water temperature shall be 230 C +/- 20 C and the duration of the immersion shall be 4 hours.
 - .2 Second immersion: the water temperature shall be 230 C +/- 20 C and the duration of the immersion shall be 20 hours.

.3 Third immersion: the water temperature shall be 600 C +/- 20 C and the duration of the immersion shall be 80 hours.

.3 After each immersion the specimens shall be towel dried and the mass recorded.

.4 The percent mass loss or gain from the original oven dry mass shall be recorded.

1.5 DELIVERY, STORAGE
AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 The waterproofing membrane shall be supplied to the job site in cakes, in the Manufacturer's sealed and labelled containers, ready for melting and application.

.3 The protection board shall be so packaged as to permit shipping, handling and storage without damage to the contents.

.4 Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Departmental Representative or other personnel.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Tack coat for Bridge Deck Surface: liquid asphalt primer to CGSB 37-GP-9Ma.

.2 Hot applied rubberized asphalt waterproofing membrane: hot applied rubberized asphalt waterproofing membrane to CAN/CGSB 37-GP-50M.

.3 Asphalt Waterproofing Membrane shall conform to the physical requirements listed below:

Test	Specification (mm)
Cone Penetration at 250°C	110 (max.)
Cone Penetration at 500°C	160 (max.)
Flow at 600°C	3 (max.)

Submit test results to the Departmental Representative one week prior to installation; however the Departmental Representative may take samples for testing at any time during the operation.

.4 Protection Boards: formed of asphalt and fillers between two sheet materials. Uniform board, free from perforations when applied. Thickness: 3.6 mm ± 0.4 mm. 1000 mm x 1500 mm with square corners and straight edges free of burrs and breakaways. All sheets of same length and width within ±5.0

mm, thickness within ± 0.25 mm. Maximum water adsorption: 5.0%, with no deterioration or loss of mass during Water Absorption Test.

- .5 Tack Coat for Protection Boards: tack coat for protection boards shall be RS-1 emulsion.

PART 3 - EXECUTION

3.1 GENERAL

- .1 All waterproofing operations shall be carried out when the air and concrete surface temperature are both 5°C or higher.
- .2 The applicator shall be approved by both the Departmental Representative and the manufacturer of the waterproofing system.
- .3 Perform the work in strict conformance with the manufacturer's written instructions and this specification. In the event there is a discrepancy between the manufacturer's written instructions and this specification, the more stringent requirement shall apply. The Departmental Representative shall have sole discretion on these matters.
- .4 Perform all of the operations involved in waterproofing in sequential order, such that there are no delays between individual operations other than those necessary to meet the requirements of these specifications.
- .5 Drainage holes through the deck shall not be plugged by waterproofing membrane, protection board or asphalt concrete.
- .6 Waterproofing operation shall not commence until the Departmental Representative has approved the preparation work.

3.2 SURFACE PREPARATION

- .1 Abrasive blast clean concrete deck to expose sound, laitance-free concrete. Remove any curing compounds.
- .2 Check the flatness of the surface after surface preparation has been completed. Areas that do not meet a 3mm in 3 m planeness shall be ground by the contractor.
- .3 Sweep all dirt and debris off the surface and dispose of before applying tack coat. Immediately prior to the application of the tack coat, the concrete surface shall be cleaned with a jet of oil-free compressed air to remove all dust and foreign material.

- 3.3 TACK COAT .1 Apply tack coat uniformly at a rate of 0.25 L/m² with approved equipment to clean and dry concrete. Do not permit equipment on tack coat until cured.
- 3.4 HEATING AND MIXING OF MEMBRANE .1 Cakes of the waterproofing membrane shall be melted on the job site in a double boiler oil heat transfer type mechanical agitated heating and mixing kettle. The unit shall keep the contents continuously agitated until the material can be drawn free flowing and lump free from the mixing kettle at a temperature with the range recommended by the manufacturer. The kettle shall be equipped with functional permanently installed dial type thermometers to measure the temperature of the melted compound and the oil.
- .2 Waterproofing membrane shall not be applied until the tack coat has cured completely and is free of any surface moisture and dirt. Apply the waterproofing within the temperature range recommended by the manufacturer in the following sequence:
- .1 Apply the waterproofing along the edge of the deck for the width of 300 mm and up the face of the curbs to the height of 80 mm. Apply the waterproofing along the joint between the deck and approach slab (two locations) for a width of 400 mm between curbs.
- .2 Place a sheet of rubber membrane reinforcement (minimum 150 mm wide by 1.2 mm thick) up the face of the curbs at a height of 40 mm. Place a sheet of rubber membrane reinforcement (minimum 300 mm wide by 1.2 mm thick) at each joint between the deck and approach slab. Rubber membrane to be placed while the waterproofing is still sticky.
- .3 Apply waterproofing over the rubber membrane reinforcement.
- .4 Apply the waterproofing to the tack coated deck so as to form a uniform film having a thickness of 5 +/- 1 mm, unless otherwise specified and approved by the Departmental Representative.
- 3.5 APPLICATION OF MEMBRANE AND MEMBRANE REINFORCEMENT .1 Place protection boards on the waterproofing membrane while the surface is still tacky with the length of the board transverse to the deck centerline. Materials or substances shall not be applied to remove the tackiness prior to installation of the protection board.
- .2 Protection boards shall be placed with edges overlapping 25 mm transversely, unless otherwise approved by the Departmental Representative.
-

- .3 The protection board edge shall be within 6 mm of all curbs and drain verticals. Place protection boards such that the longitudinal (direction of traffic flow) joints are staggered a minimum of 150 mm.
- .4 The protection boards shall remain free from perforation when applied.

3.6 TACK COATING OF
PROTECTION BOARD

- .1 Apply a tack coat of RS-1emulsion at a rate of 0.14 L/m² or as directed by the Departmental Representative. Tack coat material shall be applied to the protection board with approved equipment which will provide a uniform application at the required rate. The tack coat shall be applied only when the protection board is dry, clean and when air temperature is above 5°C. The tack coat shall be placed just sufficiently ahead of paving to allow for adequate curing.

3.7 PAVING OF BRIDGE
DECK AND APPROACH
SLABS

- .1 Place asphalt concrete paving of bridge deck and approach slabs within 48 hours of the completion of waterproofing or as otherwise directed by the Departmental Representative.
- .2 Place asphalt concrete without disturbing or damaging the waterproofing system. Immediately remedy any disturbance and / or damage to the waterproofing system before continuing with paving operations.
- .3 Within 24 hours of paving of the deck and approach slabs, seal the interface between the asphalt concrete and the face of the curb by pouring waterproofing along the joint such that the material extends 25 to 50 mm from the face of the curb and to a thickness of 2 to 4 mm above the asphalt concrete.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 03 30 00 - Cast-in-Place Concrete

- 1.2 REFERENCES .1 NCHRP 244, Concrete Sealers for the Protection of Bridge Structures.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing
 - .2 CAN/CGSB-37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing
- .3 Green Seal Environment Standards (GS):
 - .1 GS-11-11, Standard for Paints and Coatings
 - .2 GS-36-11, Standard for Commercial Adhesives

- 1.3 SUBMITTALS .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for water repellents and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Archaeological, Cultural and Environmental Procedures. Indicate VOC's for water repellent.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
- .5 Submit samples in accordance with Section 01 33 00 - Submittal Procedures. Samples shall demonstrate the product characteristics of the

- coating product.
- .6 Submit drawing indicating locations of coating application.
- 1.4 QUALITY ASSURANCE
- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
- .1 Store materials off ground, indoors, and in dry location, in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect water repellents from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- 1.6 WASTE MANAGEMENT
- .1 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Packaging Waste Management:
- .1 Remove for reuse by manufacturer of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.
- .3 Unused coating material must not be disposed of into the river, on to the ground or in other locations where it will pose health or environmental hazard.
- .4 Divert unused coating material from landfill to official hazardous material collections site approved by Departmental Representative.
- 1.7 SITE CONDITIONS
- .1 Ambient Conditions:
- .1 Maintain substrate temperature at water repellent installation area in accordance with water repellent manufacturer's printed
-

- instructions.
- .2 Apply coating during dry weather. Allow surfaces to dry minimum of 3 days after rainfall or cleaning before applying further coats.
- .3 Protect plants and vegetation which might be damaged by water repellents.
- .4 Protect surfaces not intended to have application of water repellents.

- .2 Environmental Limitations: conform to manufacturer's written instructions.
- .3 Substrate Conditions: do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of coatings including special conditions governing use.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Concrete coating system shall be a waterborne, highly flexible, high performance waterproofing coating for protection of new concrete formulated with internally crosslinked acrylic copolymer. The coating system shall be highly breathable yet waterproof, resistant to carbon dioxide diffusion, exceptionally UV light resistant, unaffected by wetting/drying and freeze/thaw, and dirt resistant. The coating system shall also have excellent chemical resistance in an acid environment, long term adhesion and durability, no chalking or leaching, and a high resistance to water ponding.
 - .1 The concrete coating system shall consist of a primer coat followed by a coloured top coat.
 - .2 The coating colour shall be 241P Parchment. Provide colour swatches to Departmental Representative for acceptance prior to placing order.
- .2 Sealing compound for top surface of curbs and uncoated faces of abutment and wingwalls below grade:
 - .1 100% Silane solution concrete sealer to NCHRP 24, Series II Reduction of Water Absorption. Ensure compatibility with water proofing membrane where applicable.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- 3.3 PREPARATION .1 Prepare and clean substrate surfaces in accordance with water repellent manufacturer's printed instructions.
- 3.4 APPLICATION .1 Apply water repellents using low pressure spraying apparatus, minimum of 2 coats, in accordance with manufacturer's printed instructions.
- .2 Apply concrete coating to the crash blocks (all four sides) and the exterior edge of the curbs along the full length of the bridge structure. The curb coating shall be terminated at the top edge of the 25 x 25 chamfer at the top of the curbs, leaving the top surface and the inside edge of both the narrow and wide curbs uncoated. The coating shall also be applied to the outside edges of the bridge deck and the soffit of the bridge deck from the exterior girder to the outside edges of the bridge deck for the full length of the bridge. The exposed surfaces of the wingwalls and abutments, projecting down 600mm (min) below finished grades, shall also be coated.
- .1 Do not apply if rain is imminent.
 - .2 Surface ambient temperature must not be less than 7°C or above 32°C during 24 hours after the application.
 - .3 Fresh concrete must be cured for ten days prior to application.
 - .4 Prepare surface for coating in accordance with manufacturer's recommendations.
- Install to manufacturer's recommendations.
-

- .3 Apply concrete coating to abutments and wingwalls, projecting down 600mm (minimum) below finished grades.
- .4 Apply sealing compound to top surface of curbs and to abutment and wingwall surfaces indicated. Clean overspray. Clean sealant from adjacent surfaces. After concrete has cured and surface of concrete is dry, apply one coat of silane concrete sealer uniformly to all surfaces indicated. First application shall be 165mL/m². Do not apply silane sealer to damp surfaces. allow coatings to thoroughly dry prior to applying subsequent coatings.
- .5 Do not leave uncoated any exposed concrete surface above grade.

3.5 FIELD QUALITY CONTROL

- .1 After water repellent has dried, spray coated surfaces with water to verify coating coverage. Allow Departmental Representative to witness tests.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at the end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling] in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by water repellent application.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 REFERENCES .1 American Society for Testing and Materials (ASTM):
- .1 ASTM C 719-14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - .2 ASTM C793-05(2010), Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.
 - .3 ASTM C1193-13, Standard Guide for Use of Joint Sealants.
 - .4 ASTM C1330-02(2013), Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - .5 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .6 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.
 - .7 ASTM D5893/D5893M-10, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- .2 Canadian General Standards Board (CGSB):
- .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 General Services Administration (GSA) -Federal Specifications (FS):
- .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS): Material Safety Data Sheets (MSDS).
- 1.3 SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
-

Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Archaeological, Cultural and Environmental Procedures.
- .2 Samples:
- .1 Submit 2 samples of each type of material and colour.
 - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .3 Manufacturer's Instructions:
- .1 Submit instructions to include installation instructions for each product used.
- .4 Sustainable Design Submittals:
- .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
- .5 Submit standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions. Indicate width, width to- depth ratio, thickness of joint sealant, and depth of recess limitations recommended by manufacturer.
- .6 Preconstruction field-adhesion test reports.
- .7 Field quality control adhesion test reports.
- 1.4 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- 1.5 QUALITY ASSURANCE
- .1 Preconstruction Field-Adhesion Testing: Prior to installing pavement sealants, field test adhesion to joint substrates using ASTM C1193 Method A.
-

Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Departmental Representative.

- 1.6 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- 1.7 WASTE MANAGEMENT AND DISPOSAL
- .1 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
 - .4 Divert unused joint sealing material from landfill to official hazardous material collections sites approved by Departmental Representative.
 - .5 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic material destined for recycling.
 - .6 Fold up metal banding, flatten, and place in designated area for recycling.
- 1.8 PROJECT CONDITIONS
- .1 Environmental Limitations: conform to manufacturer's written instructions.
 - .1 Do not install silicone sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
-

- .2 Do not install sealants when temperature is above 50° C or below 4.4°C.
- .3 Do not install sealant when temperature is at or below dew point (the temperature at which the air is saturated with moisture vapor and liquid water (dew) begins to form).

.2 Substrate Conditions:

- .1 Do not proceed with installation of materials until contaminants capable of interfering with adhesion are removed from substrates.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 One-part, non-sag silicone material that cures to a low-modulus silicone rubber sealant designed for sealing joints in Portland cement concrete and accommodates typical thermal movements to the following requirements.

Test Method	Test	Value
ASTM D2202	Slump of Sealants	< 7.6mm
ASTM C1183	Extrusion Rate	90 - 250 g/min
ASTM C679	Tack Free Time	5 hours max.
ASTM C792	Heat Aging	3.05% loss max.
ASTM C661	Durometer Shore A-2	15 - 25
ASTM C792	Specific Gravity	1.450 - 1.515
As Cured - 21 Days at 25°C and 50% RH		
ASTM D412	Ultimate Elongation	≥ 1200%
ASTM D412	Tensile Stress @ 150%	28 psi (45 psi max.)
Performance		
ASTM C719	Movement, 10 Cycles at +100%/-50%	No Failure
ASTM C793	Accelerated Weathering at 5,000 hours	No cracks, blisters or bond loss

- 2.2 JOINT CLEANER
- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
 - .2 Primer: in accordance with sealant manufacturer's written recommendations.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 SURFACE PREPARATION
- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
 - .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
 - .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
 - .4 Ensure joint surfaces are dry and frost free.
 - .5 Prepare surfaces in accordance with manufacturer's directions.
 - .1 Remove laitance, form-release agents, dust, and other contaminants.
- 3.3 PRIMING
- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
 - .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.
-

-
- 3.4 BACK-UP MATERIAL
- .1 Apply bond breaker tape where required to manufacturer's instructions.
 - .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- 3.5 MIXING
- .1 Mix materials in strict accordance with sealant manufacturer's instructions.
- 3.6 APPLICATION
- .1 Apply sealant to the following:
 - .1 Between approach slab and abutment back wall.
 - .2 Between approach slab and wingwalls.
 - .3 At bridge deck curb joints.
 - .4 At locations indicated on the drawings.
 - .2 Apply sealant in accordance with manufacturer's written instructions.
 - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .4 Apply sealant in continuous beads.
 - .5 Apply sealant using gun with proper size nozzle.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Remove excess compound promptly as work progresses and upon completion.
 - .8 Curing:
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
 - .9 Examine joint profiles and surfaces to determine if work is ready to receive paving sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with paving sealant work once conditions meet sealant manufacturer's recommendations.
 - .1 Comply with width, width-to-depth ratio, thickness of joint sealant, and depth of recess limitations published by manufacturer for specific products.
 - .10 Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.
 - .11 Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing. Apply recommended primer
-

using sealant manufacturer's recommended application techniques. Allow to dry according to manufacturer's recommendations prior to sealant application.

- .12 Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of paving sealant allowing optimal sealant movement. Install continuously without gaps, twisting, stretching, or puncturing backing material. Use gauge to ensure uniform depth to achieve correct profile, coverage, and performance.
- .13 Apply sealant to manufacturer's instructions. Comply with recommendations in ASTM C1193.
 - .1 Tool non-sag type sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
 - .1 Provide concave, smooth, uniform, sealant finish. Eliminate air pockets and ensure complete contact on both sides of joint opening.
 - .2 Tool joints with one continuous stroke.
 - .3 Use tooling agents recommended by sealant manufacturer for application.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean adjacent surfaces immediately.
 - .3 Remove excess and droppings, using recommended cleaners as work progresses.
 - .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facilities.
- .4 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease, and other matter which may impair Work using materials and methods recommended by sealant manufacturer.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 05 12 33 - Structural Steel for Bridges
- 1.2 REFERENCES .1 All work covered under this contract shall be as per the contract documents as well as all relevant Canadian and Ontario Provincial Standards unless noted otherwise in contract documents.
All referenced standards in this section shall be current issue or latest revision at the first date of project tender advertisement.
- .2 Canadian General Standards Board (CGSB):
.1 CGSB-GP-12C, Standard Paint Colours, Parts 1 of
.2 CGSB 1-GP-171M, Coating, Inorganic Zinc
.3 CGSB 1-GP-180Ma, Coating, Polyurethane, Two Package, General Purpose
.4 CGSB 164-GP-IMP, Leachate Extraction Procedure
- .3 Canadian Standards Association (CSA International):
.1 CAN/CSA S6-14 Canadian Highway Bridge Design Code (CHBDC)
.2 CAN/CSA-S269.2-M87, Access Scaffolding for Construction Purposes, the National Building Code of Canada
- .4 Steel Structure Painting Council (SSPC):
.1 SSPC-SP 1-82 (R2004), Solvent Cleaning
.2 SSPC-SP 2-82 (R2004), Hand Tool Cleaning
.3 SSPC-SP 3-82 (R2004), Power Tool Cleaning
.4 SSPC-SP 6/NACE No. 3-07, Commercial Blast Cleaning
.5 SSPC-SP 7/NACE No. 4-07, Brush-off Blast Cleaning
.6 SSPC-Vis-1-89, Visual Standard for Abrasive Blast Cleaned Steel
.7 (Standard Reference Photographs) Editorial Changes September 1, 2000 (Steel Structures Painting Manual, Chapter 2 - Surface Preparation Specs.)
.8 SSPC-SP 10/NACE No. 2-07, Near White Blast Cleaning
.9 SSPC-PA 204, Measurement of Dry Coat Thickness with Magnetic Gauges. SSPC Good Painting Practices, Volume 1, 4th Edition
.10 SSPC PS 20.00, Zinc-Rich Primers
.11 SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations
.12 SSPC-Guide 7, Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
.13 NEPCOAT Qualified Products List A for Protective Coatings for New and 100% Bore

Existing Steel for Bridges

- .5 Ontario Provincial Standard Specifications (OPSS) <http://www.ops.on.ca/>:
 - .1 Construction Specification for Coating Structural Steel Systems OPSS.PROV 911, November 2014
 - .2 Material Specification for Paint Coating Systems for Structural Steel OPSS.PROV 1704, November 2014

All references to the Contract Administrator shall be understood to mean the Departmental Representative.

- .6 Federal Standard (FS):
 - .1 FED-STD-595C, Colours Used in Government Procurement

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Written Notice submission shall show conformity with the contract documents and shall include:
 - .1 Details of the methods, procedures, and sequence of operations to be employed to complete the work, including Working Drawings and schedules.
 - .2 Details of surface preparation and coating of areas that are difficult to access and the method of application.
 - .3 Procedures for achieving the specified substrate surface preparation particularly at edges and welds surfaces
 - .4 Details of the proposed method for management of spent material.
- .3 The Written Notice Submission shall be submitted for approval by Departmental Representative at least 8 weeks prior to the application of paint or preparation of surfaces to receive paint.
- .4 Working Drawing submissions shall include:
 - .1 When the Contract contains a tender item for environmental protection, the Working Drawings shall include a detailed description of the environmental protection to be employed, including details of the enclosure, erection of the enclosure, and relocation procedure for the enclosure and equipment.
 - .2 Working Drawings shall show the location and magnitude of all applied construction loads in accordance with OPSS 911.04.02.03.02 and 911.04.02.03.02.01 a).
- .5 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for painting exterior metal surfaces and include:
 - .1 Recommended maximum dry film thickness;
 - .2 Mixing and thinning directions;
 - .3 Recommended spray nozzles and pressures;
 - .4 Recommended temperature range and acceptable humidity levels for application;
 - .5 Minimum acceptable recoat time for temperatures in intervals of 5°C from 0°C to 30°C;
 - .6 Product characteristics;
 - .7 Performance criteria;
 - .8 Physical size;
 - .9 Finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
 - .6 Samples:
 - .1 Provide for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Upon request, Departmental Representative will furnish qualified products list of paints.
 - .4 Paints shall be on the MTO Road Authority Approved Products List.
 - .5 Enable Departmental Representative to take 1L samples of each paint delivered to site, one sample from manufacturer's containers and one sample from painters' pot.
 - .7 Coating manufacturer's certificates:
Before commencing coating provide product certificates signed by manufacturer certifying materials comply with Contract Documents, manufacturer's current product data sheets, specified performance characteristics and criteria and physical requirements.
 - .8 Certification of Abrasive Media:
 - .1 Prior to abrasive blasting, the Contractor shall supply the Departmental Representative with written certification from a laboratory certified by an
-

organization accredited by the Standards Council of Canada stating that the abrasive media meets the material requirements specified in this specification.

- .9 Test Reports:
 - .1 Submit test reports showing compliance with specified performance characteristics and physical properties and in accordance with Section 01 45 00 - Testing and Quality Control.

 - .10 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Provide project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Provide calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Provide listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
 - .3 Regional Materials: Provide evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

 - .11 Submit three copies of the following prior to the start of coating operations.
 - .1 Abrasive to be utilized along with manufacturer's specifications.
 - .2 Coating(s) to be utilized along with the manufacturer's specifications.
 - .3 Material Safety Data Sheets for all products. MSDS must remain at the place of work at all times.
 - .4 Design of platform, scaffolds and enclosure stamped by a Professional Engineer registered in Ontario.

 - .12 Quality control and quality assurance records shall be submitted to the Departmental Representative and shall form part of the final submission documentation.
-

- 1.4 QUALITY ASSURANCE
- .1 The quality assurance shall be in accordance with OPSS 911.08, OPSS 1704.08 and Contract Document amended or supplemented by the addition of the following sections.
 - .2 Access for inspection to all portions of work shall be provided and maintained by the Contractor.
 - .3 NACE certified inspector must inspect and approve all coatings on new steel.
 - .4 All material and equipment furnished and work done, shall be subject to inspection by the Departmental Representative. An appointed inspector may be on site during all operations. Such inspection shall not relieve the Contractor of the responsibility for furnishing the qualified labour, equipment, staging, etc., necessary to meet the requirements of this specification, or the safe accessibility to the work for the purposes of inspection.
 - .5 Keep accurate records containing details such as weather, temperatures, dew points and times for the various coating applications and shall make these records available to the Departmental Representative upon request.
 - .6 All work shall be subject to inspection by the Departmental Representative or appointed representative, who shall be given at least 48 hours' notice prior to work commencing. The Contractor shall coordinate activities with the Departmental Representative to ensure that all aspects of the work are inspected. Defective work not conforming to this specification shall be repaired at no additional cost.
 - .7 Methods of inspection and inspection procedures shall be as directed by the Departmental Representative, who shall govern both methods and standards. All findings will be recorded and will become part of the Project's Quality Assurance Records.
 - .8 Coating inspection shall be performed in accordance with the procedures outlined in SSPC Manual, Volume 1, Chapter 5, "Inspection".
 - .9 When necessary, the testing of ambient and surface temperature and humidity shall be done by thermometer, surface thermometer and psychrometer with recognized psychrometric tables.
-

.10 Destructive testing may be required where inadequate adhesion of the coating(s) is suspected. Adhesion testing shall be done in accordance with ASTM D4541. The minimum adhesion of the coating under evaluation shall be 1.7 MPa (250 psi). Coatings damaged as the result of destructive testing shall be repaired at no extra cost to the Contract. Repair procedures and materials shall be approved by the Departmental Representative prior to application.

1.5 DELIVERY, STORAGE
AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - General Product Requirements, as well as the packaging, delivery and Acceptance Requirements as per OPSS 1704.07.02, and with manufacturer's written instructions.

.2 All coating materials shall be supplied in new condition. Two component coatings shall be packaged separately.

.3 Coating components shall be packaged in proportions that are consistent with the manufacturer's normal method of packaging.

.4 Handling and storage of spent materials to be as per OPSS 911.07.08.09.

.5 Containment around equipment and materials stored to be as per 911.07.08.10.

.6 Remedial work related to environmental protection to be as per 911.07.08.11.

.7 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.

.8 Packaging Waste Management: remove for reuse by manufacturer of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 01 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint Coatings:
Paint coating material shall be in accordance with OPSS 1704.05. An MTO road authority approved three coat low VOC epoxy zinc/epoxy/polyurethane system according to OPSS 1704 shall be used unless noted otherwise herein.

- .1 Section 1704.05.01.02 is amended by the revision of finish colour as follows:
The colour of the finish coat shall be FS-595C 15052 Blue for all structural steel or FS-595C 162651 Grey as specified in Contract Documents, both according to Federal Standard 595C Colors.
 - .2 Section 1704.05.01.01 is amended by the addition of the following:
All coatings/paint systems shall be from a single manufacturer.
 - .3 Section 1704.05.01.03 is amended by the addition of the following:
All coating shall be completed in shop
 - .4 Only paint coatings contained in the original containers sealed by the manufacturer shall be used.
-
- .2 Primer coat shall be a class B zinc-rich coating in accordance with CAN/CSA-S16 acceptable for slip critical bolted connections.
 - .3 Acceptable products: the contractor is responsible for ensuring that the latest formulation of the proposed coating products to be utilized in the work satisfies the requirements of this specification. All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval.
 - .4 Paint coating systems for coating galvanized surfaces:
Where specified in the Contract Documents, one of the approved paint coating systems for coating galvanized surfaces shall be applied to hot dipped galvanized components that require subsequent paint coating. The colour of the finish coat shall be the same as coating specified above in Section 2.1.1.
 - .5 Abrasive Media:
 - .1 Abrasive blast media shall be clean and sharp silica sand, washed industrial sand, steel grit, or a slag material of suitable size, weight and angular shape to produce the degree of cleaning specified and anchor pattern/profile required. The blast media shall contain no more than 1% by weight of water soluble solids. There shall be less than 10ppm oil in the abrasive and no trace of salts or toxic material. When cleaning by air blasting with sand abrasives,
-

- adequate separators and traps shall be provided to remove detrimental amounts of water and oil from the compressed air before it reaches the nozzle.
- .2 Sand for sandblasting: to SSPC-SP 10/NACE No. 2-07 Commercial Blast Cleaning (Steel Structures Painting Council).
 - .3 Materials unsuitable for use in the work shall be disposed of offsite in an approved manner at no additional cost to the Contract. Re-claimed abrasive material will not be acceptable with the exception of steel grit.
 - .4 Abrasive media shall also be as per OPSS 911.05.03.
- .6 Compressed air used during all work operations shall be clean, dry, and free from oil residues, when tested according to ASTM D 4285.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for painting exterior metal surfaces installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Carry out tests to determine existence of lead base paint on existing exterior metal surfaces.
 - .3 If lead exists stop work and report findings to Departmental Representative.
 - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Coating systems shall be as detailed in these specifications and Contract Documents. The manufacturer's data sheets and referenced Ontario Provincial Standard Specifications are part of this specification. Should there be any conflict between these specifications, the decision of the Departmental Representative shall prevail.
- .2 General construction requirements of 911.07.01 and operational constraints of 911.07.02 shall also apply.

- .3 All surfaces to be coated shall be free from contamination prior to any application. No coating work shall be done when the surface is less than 3°C above the dew point, nor when it is likely that there will be a change in the weather within four (4) hours of application that would be detrimental to the coating system. All coatings shall be uniformly applied without sags, foreign material, dust, contamination, cracks or other blemishes. Defects shall be removed and repaired to the satisfaction of the Departmental Representative.
- .4 The Contractor shall arrange for site visits from the coating manufacturer's technical representative a minimum of one visit per month while the job is in progress. For projects scheduled for completion in less than one month, the manufacturer's representative shall arrange to visit the site at least once. After each visit, the manufacturer's representative shall provide a written report to the Departmental Representative within 5 working days.
- .5 All coating work and systems for the purpose of this specification shall be considered a fully cured system prior to being accepted by the Departmental Representative. No accelerators for the purpose of force curing the coating system will be accepted without prior written approval. No coating shall be applied when the wind speed exceeds 15 km per hour unless the Contractor can demonstrate to the Departmental Representative that adequate precautions have been made available which are acceptable to the Departmental Representative. The decision of the Departmental Representative shall be final.

3.3 PREPARATION

- .1 General surface preparation for all structural steel to be as per OPSS 911.07.03.01.
- .2 New Metal Surfaces:
 - .1 Clean surfaces of new metal to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and foreign substances in accordance with the following:
 - .1 Abrasive blast cleaning: to SSPC-SP 10/NACE No. 2.
 - .2 The abrasive blast cleaning shall provide a surface profile height of a minimum of 40µm and a maximum of 75µm.
 - .2 Unpainted steelwork shall be tested to ensure that soluble salts on the surface are less than 2 µg/cm².

- .3 Existing Metal Surfaces:
 - .1 Clean surfaces by removing loose, cracked, brittle or non-adherent paint, rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with following.
 - .1 Abrasive blast cleaning: to SSPC-SP 10/NACE No. 2.
 - .2 The abrasive blast cleaning shall provide a surface profile height of a minimum of 40µm and a maximum of 90µm for paint coating application.
 - .2 Commercial blast clean rusted and bare metal surfaces where existing paint system has failed.
 - .3 Brush-off blast clean remaining metal surfaces to be painted.
 - .4 Scrape edges of old paint back to sound material where remaining paint is thick and sound, feather exposed edges.
- .4 Compressed air to be free of water and oil before reaching nozzle.
- .5 Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, by blowing with clean dry compressed air, or by vacuum cleaning.
- .6 Galvanized surfaces: Galvanized surface to be paint coated to be prepared in accordance with OPSS 911.07.03.04
- .7 Apply paint after prepared surfaces have been accepted by Departmental Representative.
- .8 Prior to starting paint application ensure degree of cleanliness of surfaces is to SSPC-Vis 1.
 - .1 Apply primer, paint, or pretreatment after surface has been cleaned and before deterioration of surface occurs.
 - .2 Clean surfaces again if rusting occurs after completion of surface preparation.
- .9 Mixing Paint:
 - .1 Do not dilute or thin paint for brush application.
 - .2 Mix ingredients in container before and during use and ensure breaking up of lumps, complete dispersion of settled pigment, and uniform composition.
 - .3 Do not mix or keep paint in suspension by means of air bubbling through paint.
 - .4 Thin paint for spraying according to manufacturer's written instructions. If

directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

- .10 Number of Paint Coats: 3.
 - .1 New Metal Surfaces:
 - .1 Shop: 1 zinc rich primer coat (class B slip resistance) to minimum DFT in accordance with OPSS 911.07.04.02.06.
 - .2 Shop: 1 epoxy mid-coat to minimum DFT in accordance with OPSS 911.07.04.02.06.
 - .3 Shop: 1 polyurethane top-coat to minimum DFT in accordance with OPSS 911.07.04.02.06.
 - .2 Repainting existing metal surfaces (preferably done in shop).
 - .1 One primer coat to minimum DFT in accordance with OPSS 911.07.04.02.06 to bare and commercial sand blasted areas.
 - .2 One epoxy mid-coat to minimum DFT in accordance with OPSS 911.07.04.02.06.
 - .3 One polyurethane top-coat to minimum DFT in accordance with OPSS 911.07.04.02.06.
- .11 Steel surface profile requirements unless noted otherwise shall be a minimum of 20% of the total film thickness specified, or as recommended by the coating manufacturer to achieve good coating adhesion and coverage.
- .12 Equipment: abrasive blast cleaning equipment shall be of a quality and size sufficient to perform the work within the time available in the contract. Blast equipment must have adequate in line "driers" to ensure moisture is completely removed during blasting operations. All spray and blasting equipment must be adequately grounded to avoid build-up of static electricity. Detrimental amounts of water and oil shall be removed from any compressed air supply used for blast cleaning by means of appropriate functional traps, separators and heaters before the airstream reaches the nozzles.
- .13 All deposits of oil or greasy contamination shall be removed in accordance with SSPCSP-1, "Solvent Cleaning" before commencing other surface preparation. Solvent wash solutions shall have prior approval.
- .14 Field coated surfaces shall be cleaned using

high pressure fresh water wash to remove all sand, dirt, carbonation, salt and other contaminants. Enclosure shall be provided at this time if necessary to prevent wash material from entering the environment. Wash water shall be filtered through an approved filter medium (e.g., non-woven geotextile, minimum tensile strength 600 N, permeability 0.22 cm/sec) prior to discharge into the environment. Total maximum chloride contamination of any surface shall not exceed 30 ppm as tested using a standard SCAT kit. The high pressure wash shall start at the top and proceed down to the bottom of the steel. Special emphasis must be placed on corner and crevices where members are joined together. Solvent wash solutions shall have prior approval.

- .15 Solvents may be used with prior approval and only for the removal of traces of oil or grease provided that the paint manufacturer confirms that any residual from the solvent will not be harmful to the paint system and provided that a cleaning agent followed by rinsing has first been tested.
- .16 Surface preparation of areas difficult to access shall be carried out to the extent practical from the access opening as detailed on the Contractor's submission for methods, procedures, and sequence of work. The surface preparation standard for these areas shall be based on reasonable effort demonstrated in the field acceptable to the Departmental Representative.

3.4 APPLICATION

- .1 The application of coating shall be in accordance with OPSS 911.07.04.01, 911.07.04.02 and Contract Documents, supplemented by the addition of the following sections.
- .2 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .3 At slip critical connections on bolted components shall the surfaces are to be coated as per OPSS 911.07.04.02.05. Do not apply mid-coat and top-coat to faying surfaces. Mask faying surfaces following the zinc primer application and do not remove masking material until mid-coat and top-coat are fully cured. Submit shop drawing of anticipated faying surfaces to Departmental Representative for review.

- .4 Apply paint by spraying, brushing, or combination of both as indicated herein. Use sheepskins or daubers when no other method is practical in places of difficult access.
 - .5 Application of coating systems:
 - .1 The zinc rich primer shall be applied to the prepared metal surface by airless spray equipment or as recommended by the manufacturer.
 - .2 The primer shall be applied at the shop.
 - .3 Application of the intermediate coat shall also be done in the shop.
 - .4 Repair all damage due to transport, erection or construction activities and ensure touch-ups blend with the shop applied top coat to provide a uniform, aesthetically pleasing end product.
 - .5 The appearance of the final product shall meet with the approval of the Departmental Representative.
 - .6 Coating of areas difficult to access shall be done from the access opening, as detailed in the Contractor's submission for methods, procedures, and sequence of work. Quality of coating application for these areas shall be based on reasonable effort demonstrated in the field acceptable to the Departmental Representative.
 - .7 All painting is to be done in shop with only field touch-up. Apply paint by spraying, brushing, or combination of both. Use sheepskins or daubers when no other method is practical in places of difficult access.
 - .8 To reduce the risks associated with the use of solvents within confined spaces the Contractor should take all reasonable measures to minimize the amount of steelwork painting that occurs within a confined space or consider the use of paint which is low in solvent.
 - .9 Use dipping or roller coating method of application when specifically authorized by Departmental Representative in writing.
 - .10 Caulk open seams at contact surfaces of built up members with material approved by Departmental Representative before second coat of paint is applied.
 - .11 Where surface to be painted is not under cover, do not apply paint when:
 - .1 Air temperature is below 5°C or when
-

- temperature is expected to drop to 0°C before paint has dried.
- .2 Temperature of surface is over 50°C unless paint is specifically formulated for application at high temperatures.
 - .3 Fog or mist occur at site; it is raining or snowing; there is danger of rain or snow; relative humidity is above 85%.
 - .4 Surface to be painted is wet, damp or frosted.
 - .5 Previous coat is not dry.
 - .6 Conditions are not within Manufacturer's recommendations.
- .12 Supply cover when paint must be applied in damp or cold weather. Supply, shelter, or heat surface and surrounding air to comply with temperature and humidity conditions specified. Protect until paint is dry or until weather conditions are suitable.
- .13 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
- .14 Apply each coat of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .15 Brush Application:
- .1 Work paint into cracks, crevices and corners and paint surfaces not accessible to brushes by spray, daubers or sheepskins.
 - .2 Brush out runs and sags.
 - .3 Remove runs, sags and brush marks from finished work and repaint.
- .16 Spray Application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Provide traps or separators to remove oil and water from compressed air and drain periodically during operations.
 - .3 Keep paint ingredients properly mixed in spray pots or containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .4 Agitators in spray pots shall extend to 25mm of the bottom of the pot to ensure proper mixing of paint components prior to spray application.
 - .5 Apply paint in uniform layer, with
-

- overlapping at edges of spray pattern.
 - .6 Brush out immediately runs and sags.
 - .7 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray. In areas not accessible to spray gun, use brushes, daubers or sheepskins.
 - .8 Remove runs, sags and brush marks from finished work and repaint.
- .17 Shop Painting:
- .1 Do shop painting after fabrication and before damage to surface occurs from weather or other exposure.
 - .2 Spray paint contact surfaces of field assembled, bolted, friction type joints with primer coat only. Do not brush primer after spraying.
 - .3 Do not paint metal surfaces which are to be embedded in concrete.
 - .4 Paint metal surfaces to be in contact with wood with full paint coats specified.
 - .5 Do not paint metal within 50 mm of edge to be welded. Give unprotected steel one coat of boiled linseed oil or other approved primer protective coating after shop fabrication is completed.
 - .6 Remove weld spatter before painting. Remove weld slag and flux by methods as specified in paragraph 3.2.3 Metal Surfaces to be Repainted.
 - .7 Protect machine finished or similar surfaces that are not to be painted but that do require protection, with coating of rust inhibitive petroleum, molybdenum disulphide, or other coating approved by Departmental Representative.
 - .8 Copy previous erection marks and weight marks on areas that have been shop painted.
- .18 Field Painting:
- .1 Paint steel structures as soon as practical after erection.
 - .2 Touch up metal which has been shop coated with same type of paint and to same thickness as shop coat. This touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.
 - .3 Field paint surfaces (other than joint contact surfaces) which are accessible before erection but which are not to be accessible after erection.
 - .4 Apply final coat of paint after concrete work is completed or as directed by
-

Departmental Representative. If concreting or other operations damage paint, clean and repaint damaged area. Remove concrete spatter and droppings before paint is applied.

- .5 Where painting does not meet with requirements of specifications, and when so directed by Departmental Representative, remove defective paint, thoroughly clean affected surfaces and repaint in accordance with these specifications.

.19 Handling painted metal:

- .1 Handle painted metal after paint has dried, or when necessary for handling for painting or stacking for drying.
- .2 Scrape off and touch up paint which is damaged in handling, with same number of coats and kinds of paint as were previously applied to metal.

3.5 QUALITY CONTROL

- .1 Quality control for coating structural steel to be as per OPSS 911.07.07.
- .2 Quality control for paint coating systems to be as per 1704.07.
- .3 Site Tests, Inspections: Upon completion of the painting procedures test for dry film reading and evaluate the results; all to SSPC-PA 2.
- .4 Timely records of quality control shall be supplied to the Departmental Representative and shall form part of the submission documentation.

3.6 FIELD DISPOSAL OF
SPENT ABRASIVE

- .1 Spent abrasive material shall remain dry at all times in accordance with SSPC Guide 7.
- .2 Representative samples of the spent blasting medium containing coating chips and dust removed from the bridge will be taken by the Departmental Representative and submitted to a laboratory to be tested according to leachate test procedures in the CGSB provisional standard 164-GP-IMP. The abrasive must be kept in a water tight enclosure until the results of the tests are known in order to ensure that no contaminants are released in to the environment.
- .3 If the leachate test results indicate the spent blasting medium is classified as a nonhazardous solid waste, then transport the medium from the project site to an approved waste disposal site at no additional cost to the Contract.
- .4 If the leachate test results indicate the spent

blasting medium is classified as a hazardous solid waste, then transport the medium to a temporary storage location that has a fenced storage compound as approved by the Departmental Representative. Required loading and transportation charges shall be included in the Contract Price. Ultimate disposal of the stored material would then become the responsibility of the Departmental Representative.

- .5 Materials that qualify under the Dangerous Goods and Hazardous Wastes Management Act must be disposed of in a manner acceptable to the Ontario Ministry of the Environment and as approved by the Departmental Representative.
- .6 All blast abrasive material shall be weighed before being delivered to site. The spent abrasive shall be weighted as it is removed from the site. Provide a weight slip every two (2) weeks for all abrasive delivered to and removed from the site. A minimum of 90% of the abrasive used in the work shall be recovered.
- .7 No additional payment will be made due to delays in sampling and/or receiving leachate test results from the spent abrasive.

3.7 REPAIR OF DEFECTS

- .1 Before application of any further coat of material, all damage and/or contamination to previous coats shall be repaired to the approval of the Departmental Representative. In the case of repair, the procedures shall be in an acceptable manner as approved by the Departmental Representative. In the case of removal, the work shall be replaced by work and materials which shall conform to the specification. This clause shall have full effect regardless of the fact that the defective work may not have been previously identified by the Departmental Representative.
- .2 Repair of paint coatings to be in accordance with OPSS 911.07.04.02.07 and 911.07.04.02.08.

3.8 ENVIRONMENTAL AND SAFETY CONTROLS

- .1 Protect and preserve the environment during the progress of the Work in conformance with OPSS 911.07.08
- .2 Provide protective enclosures and filters to contain dust or water in an effective manner and to minimize impacts from dust, water and coating particles entering the environment when washing or removing coating.
- .3 Ensure that waste materials, i.e., used

coatings, solvents and refuse will not be disposed of in the aquatic environment, elsewhere on the highway or adjacent the right-of-way. Such material shall be disposed of according with applicable legislation.

.4 All methods and materials for constructing the protective enclosure shall be in accordance with regulatory agency requirements having jurisdiction.

.5 Materials collected or accumulated within the enclosure shall be removed and contained so as to prevent their escape. The collected material shall be disposed of off the site as indicated in Clause 3.5 herein.

3.9 PLATFORMS AND ENCLOSURES

.1 Platforms and enclosures shall be provided by the Contractor where environmental protection is required, i.e., to protect the work piece or work place from the environment, or the environment from the work being performed. This shall include, but not be limited to, tents, heating or ventilating, negative air pressure, dust collectors, enclosures, etc. These shall be provided at no additional cost to the Contract. For field operations, install a full (total) enclosure surrounding all washing, coating and surface preparation activities. Refer to SSPC Guide 6.

.2 Enclosures and equipment shall be as per OPSS 911.07.08.06, 911.07.08.07 and 911.07.08.08.

.3 The plans and drawing for the enclosure, scaffolds and platforms shall be submitted for review as detailed in subsection 1.5 - SUBMITTALS. Construction shall not begin until all these documents have been reviewed. Drawings are to include, but not be limited to, the following detailed information:

- .1 Method and schedule of construction
- .2 Actual loads to be imposed on the structure.
- .3 Details of proposed attachments to the structure.
- .4 Size and shape of all platform components.
- .5 Scaffold erection and dismantling diagrams.
- .6 Material specifications and sources.
- .7 Arrangement of access platforms, ladders and guardrail.

.4 The coated areas of the structure coming into contact with rollers, clamps, and other parts of the scaffolding and access facilities shall be protected using rubber or other material to

- prevent damage to the coating.
- .5 At the conclusion of sandblasting and coating operations, the protective enclosure shall be dismantled and removed from the site.
- 3.10 EXTENDED WARRANTY .1 The Contractor shall warrant the coating system applied under the terms of this Contract for new construction to be free of defects in materials and workmanship for a period of 60 months from the date of final completion of the contract.
- .2 During the warranty period, the Departmental Representative will inspect the coating system, and will advise the Contractor and Manufacturer, in writing, of any repairs that are required. Intermediate inspections may be made and warranty repairs claimed and repaired by the Contractor and Manufacturer each year of the 60 months warranty period.
- .3 Failure of the protective coating system may include but not be limited to:
- .1 Any debonding or failure of adhesion of the coating either to the structural steel or other coatings.
- .2 The appearance of any rust stains on the coated structure due to loss of coating or leaking from joints between structural members.
- .3 Failure of the coating to resist chipping and abrasion from normal site conditions.
- .4 Any loss of normal gloss or rapid colour change.
- .4 Warranty repair will be completed within 45 days of notification, or if this would place repair in unsuitable weather conditions, by June 15 of the following year.
- .5 Repairs under warranty shall include all costs to supply material, labour and equipment necessary to restore the coating system to acceptable condition. Payment for warranty repairs will not be made separately, but will be considered included in the unit bid price for the fabricated steel trapezoidal box girders (Reference Section 05 12 33, Structural Steel for Bridges).
- 3.11 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Measures shall be taken to prevent excessive release of dust and debris on site. The Contractor shall take into account the proximity of highway or canal traffic when planning and
-

implementing measures to protect the steelwork against corrosion. Any accumulated dust/debris on external surfaces shall be cleaned with clean water prior to completion of construction.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.5 Management of excess material shall be according to Contract Documents.

3.12 PROTECTION

.1 Protect painted surfaces from damage during construction.

.2 Protection of surfaces:

.1 Protect surfaces not to receive paint.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats of paint. Remove contaminants from surface and apply paint immediately.

.3 Protect cleaned and freshly painted surfaces from dust to approval of Departmental Representative.

.3 Repair damage to adjacent materials caused by painting exterior metal surface application installation.

END OF SECTION

PART 1 - GENERAL

1.1 MANUFACTURE OF
HYDRAULIC EQUIPMENT

- .1 The supply of new components of the hydraulic system shall be the responsibility of one (1) company only. This company shall be a recognized manufacturer of high-pressure oil-hydraulic systems and shall be acceptable as such to the Departmental Representative.
- .2 The hydraulic system shall be constructed as shown on the Contract Drawings and designed for low maintenance requirements and to facilitate easy maintenance and troubleshooting.

1.2 SUPPLIER
QUALIFICATIONS

- .1 Fabrication of the power units shall be done in a qualified shop with successful prior of experience in the design and manufacture of hydraulic systems for the movable bridge industry or similar.
- .2 Design review, calculations, preparations of shop drawings, fabrication, shop testing and field testing must be supervised by a Professional Engineer who has been responsible for the design of at least one (1) hydraulic systems to operate a swing bridge and the design of at least two (2) industrial hydraulic systems similar in size. The Professional Engineer must: make, sign and submit all calculations; check, seal and sign all shop drawings; inspect the installation of installed hydraulic systems and accessories to verify that they were properly installed, have all required components, are mechanically sound and are safe to operate. A certificate must be provided to the Departmental Representative upon successful completion of start up and functional checkout.
- .3 Piping, flushing, installation and adjustment of hydraulic components shall be done under the direction of a Certified Fluid Power Technician, Certified Fluid Power Specialist or Certified Fluid Power Engineer with successful prior job experiences within the movable bridge industry or similar.

1.3 LIMITS OF WORK

- .1 The limits of work included for this section are primarily as indicated on drawings M1, M2, M4, M9, M10, M13 and M14 of the Contract Drawings and as specified herein.

1.4 STANDARDS

- .1 All new hydraulic items must meet the requirements of the National Standard of Canada CAN/CSA-S6-14 Canadian Highway Bridge Design Code, hereinafter referred to as CHBDC.

- .2 The design of the hydraulic actuator system shall conform to ANSI 14.17. Record as-built changes in accordance with National Fluid Power Association Standard Section 7.4.3.
 - .3 Standards referred to in the Contract Documents are published by the following organizations and are directly applicable to the material and workmanship required by this item.
 - .1 ASTM - American Society for Testing and Materials
 - .2 ANSI - American National Standards Institute
 - .3 CSA - Canadian Standards Association
 - .4 AWS - American Welding Society.
 - .5 SSPC - The Society for Protective Coatings.
 - .6 NFPA - National Fluid Power Association
- 1.5 SUBSTITUTIONS
- .1 Items specified by manufacturer name or part number on the Contract Drawings may be replaced by an equivalent item by another manufacturer, subject to approval by the Departmental Representative, with the understanding that all changes required by the substitution are made at no additional cost. Item equivalence shall be determined at the sole discretion of the Departmental Representative and may be based on one or more of the following: quality, function, ease of maintenance, physical size, reliability, value, load capacity (static and dynamic), durability, availability and other criteria as deemed appropriate by the Departmental Representative.
- 1.6 PERFORMANCE
- .1 The hydraulic schematic in the Contract Drawings is provided, in combination with the requirements of the Specifications, to show the design intent for the hydraulic system for tendering purposes. The hydraulic system supplier is responsible for final selection of all components. Even if no changes to the circuit are made, the hydraulic system supplier shall be responsible for reviewing the design and ensuring that the system will meet the performance requirements herein. If, in the opinion of the hydraulic system supplier, modifications are necessary to meet any of the requirements, this shall be brought to the attention of the Departmental Representative ten (10) days prior to the tender closing. Any troubleshooting, including materials and labour to modify the circuit during field start up, which is necessary to achieve acceptable performance of the completed system shall be performed at no additional cost.
 - .2 The performance requirements of the swing span hydraulic operation circuit are as follows:
-

- .1 Provide operation to start, smoothly accelerate (continuous acceleration from zero speed to normal speed) the swing span, run at normal speed, smoothly decelerate (continuous deceleration from normal speed to creep speed) the swing span to creep speed and stop the span.
- .2 Creep and normal speeds shall be independently field adjustable.
- .3 Once set, speed of operation shall be constant and independent of changes in external loading on the swing span (for wind load range between 0 to 5 psf). For wind speeds producing pressures greater than 5 psf (0.24 kPa) the speed of the swing span may be reduced as per code.
- .4 Time of operation for a 90-degree swing shall be approximately 60 seconds.
- .5 System maximum pressure, which may not be exceeded during any operational condition including during an emergency stop is 3000 psi (207 bar).
- .6 When stopped, the hydraulic system shall prevent the span from drifting when subjected to external loading.
- .7 Needle valves on end lifts, span lock and guard gates circuits shall be adjusted to achieve approximately 5 second operation time or as directed by the Engineer.

1.7 ADMINISTRATIVE

- .1 Submit to the Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Do not proceed with Work affected by submittal until review is complete.
 - .3 Present shop drawings, product data, samples and mock ups in SI Metric units. Imperial units may also be included where applicable.
 - .4 Where items or information are not produced in SI Metric units converted values are acceptable.
 - .5 Review submittals prior to submission to the Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be
-

returned without being examined and considered rejected.

- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work is coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by the Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Departmental Representative's review.
- .10 Keep one reviewed copy of each submission on site.

1.8 DIMENSIONS/
CERTIFIED DRAWINGS

- .1 Dimensions indicated on the Contract Drawings are nominal and intended for information. Many of the dimensions indicated on the Contract Drawings have been obtained from existing drawings or from information provided by various machinery manufacturers. The dimensions have not been field verified or obtained from certified drawings from the various manufacturers. All dimensions indicated on the Contract Drawings must be verified in the field or from certified drawings from the various machinery manufacturers by the Contractor. Notify the Departmental Representative of any dimensional deviations found during the verification. Make all required field measurements and obtain certified dimensions for all manufactured products necessary before shop drawings, fabrication, and installation may proceed. The Contractor is solely responsible for converting dimensions from Metric to Imperial units, or vice versa, as required.

1.9 SUBMITTALS

- .1 Shop drawings, erection drawings, machinery installation procedures, final record drawings, and other required submittals specified herein, shall be submitted in accordance with the requirements of the Contract.
- .2 Submit complete drawing packages for all hydraulic machinery systems as follows:
 - .1 Hydraulic System Schematic
 - .2 Hydraulic System Power Unit
 - .3 Hydraulic System Piping Layout and Supports

Any submittals that do not contain all documents required for the manufacture, assembly and erection of the hydraulic systems will be returned without review.

1.10 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 Submit drawings stamped and signed by a professional engineer registered or licensed in Ontario, Canada.
 - .3 Provide a detailed shop drawing submittal schedule to the Departmental Representative within thirty (30) days of the "Notice to Proceed".
 - .4 Draw all shop drawings to scale (excepting hydraulic system schematics) and provide the scale on the drawings. Ensure that details of a given part are clearly visible at the scale selected for that part with the exception that enlarged views of small details within a part may be used to improve clarity and prevent excessively large drawings.
 - .5 Indicate materials, methods of construction and attachment or anchorage, connections, schedules for fabrication, shop assembly procedures, diagrams showing sequence and details for erection, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
 - .6 Identify conflicts between manufacturers' instructions and Contract Documents and submit resolution for review and approval.
 - .7 Identify variations between Contract Documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - .8 Submit copies of producer or manufacturer data. This includes specifications, tests and installation instructions for the following items, but not excluding other items or materials not specifically mentioned.
-

- .1 Mill reports and physical tests of all metals
 - .2 Bolts, nuts, washers and other fasteners
 - .3 Paint
 - .4 Lubricants
 - .5 Standard stocked items

 - .9 Allow fifteen (15) working days for the Departmental Representative's review of each submission.

 - .10 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to proceeding with Work.

 - .11 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

 - .12 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number
 - .3 Contractor's name and address
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 A sequential number (i.e. number resubmittals with the original submittal number and an alphabetic suffix)
 - .6 Other pertinent data.

 - .13 Submissions shall include
 - .1 Date and revision dates
 - .2 Project title and number
 - .3 Name and address of:
 - .1 Subcontractor
 - .2 Supplier
 - .3 Manufacturer
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents
 - .5 A complete shop bill of materials for all machinery parts
 - .6 Details of appropriate portions of Work as applicable:
 - .1 Fabrication
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances
 - .3 Setting or erection details
 - .4 Capacities
-

- .5 Performance characteristics
 - .6 Standards
 - .7 Operating weight
 - .8 Wiring diagrams
 - .9 Single line and schematic diagrams
 - .10 Relationship to adjacent work
 - .11 Instructions for painting the machinery
 - .12 All appropriate weld symbols along with stress relieving process for weldments
 - .13 The surface finish of machined surfaces and tolerances for each dimension for which a specific fit is required. Fit and finish per CHBDC Sections 13.7.5 and 13.7.6.
 - .14 Dimension parts to ensure that components of a common purpose that are fabricated from the same detail are interchangeable.
 - .15 Tolerances for all drawing dimensions, either directly or via a standard title block, as necessary to obtain proper fit and function of assembled components.
 - .16 The required tension method of tightening and all other pertinent information for all machinery connection bolts.
 - .7 Proprietary parts shown in outline on the drawings with sufficient dimensions and data to determine the clearances required for installation and operation.
 - .8 Certified dimension prints from equipment manufacturers stating pertinent ratings of the equipment, and indicating, when applicable, provisions for adding, draining, and checking the lubricant, method of lubrication, amount and type of lubricant required and type of fittings, the location of inspection openings and the location and type of venting devices.
 - .9 Complete assembly and erection drawings shall be furnished. These drawings shall be given identifying marks and essential dimensions for locating each part or assembled unit with respect to the bridge or equipment foundation. Every part shall be cross referenced to the sheet on which it is detailed. Contract Drawings shall not be submitted as a substitute for assembly or erection drawings.
 - .10 Indicate on the shop drawings, for review by the Departmental Representative, the type of tightening, type of wrench and the value of torque or other pertinent information of all connection bolts for all items and machinery.
-

- .14 After the Departmental Representative's review, distribute copies.
 - .15 Submit electronic copies of product data sheets or brochures for requirements requested in the specifications where shop drawings will not be prepared due to standardized manufacture of product.
 - .16 Submit electronic copies of test reports for requirements requested in the specifications and as requested by the Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three (3) years of date of contract award for project.
 - .17 Submit electronic copies of certificates for requirements requested in the specifications and as requested by the Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .18 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .19 Submit electronic copies of manufacturer's field reports for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .20 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .21 Delete information not applicable to project.
-

- .22 Supplement standard information to provide details applicable to project.
- .23 If upon review by the Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, approved electronic documents will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.11 SYSTEM
REQUIREMENTS

- .1 Identify, in accordance with National Fluid Power Association Stands, all components including those located within manifolds, mounting plates, pads or fittings. Design the system so that all components are easily installed, adjusted, inspected, and maintained.
- .2 Environmental Protection: Design system so that all parts, motors, pumps, etc. are mounted over a stainless-steel drip pan to contain the entire volume of fluid plus 10%.
- .3 System Controls: System controls shall conform to National Fluid Power Association Standards. Provide starting and stopping functions for the prime mover and shifting functions for the proportional and directional control valving.

1.12 INSTALLATION
PROCEDURE

- .1 Prepare a detailed written installation procedure for the installation of all hydraulic machinery. Include sequence of installation, bolt tightening methods and required tension values for all bolts. Include resumes for all Certified Fluid Power Technicians, Specialists or Engineers who will be responsible for the work with the written installation procedure.
 - .2 Demonstrate to the Departmental Representative that the Contractor has full knowledge of hydraulic procedures and that the work will be performed by qualified Certified Fluid Power Technicians.
 - .3 Begin installation of the system after the procedures and resumes have been submitted by the Contractor and they are satisfactory in the sole opinion of the Departmental Representative. Correct and resubmit the procedure and/or submit resumes for alternate personnel as necessary to the satisfaction of the Departmental Representative. This resubmission procedure, if required, is not cause for delay.
-

-
- .4 Ship hydraulic machinery items to the job site after the Contractor has submitted a satisfactory installation procedure.
- 1.13 SHIPPING AND HANDLING .1 Power units, valve stands, and cylinder assemblies shall be shipped to the site fully assembled. Prior to shipment, securely seal hydraulic equipment fluid ports. Prior to installation, store units fully assembled indoors in a clean, dry, dust-free environment.
- 1.14 FINAL AS-BUILT DRAWINGS .1 Submit drawings for all materials as fabricated following fabrication. Clearly indicate any deviations from the approved shop drawings. Stamp these drawings "As Built", immediately above the title block.
- 1.15 MAINTENANCE MANUAL .1 Contents of Manual
- .1 Table of contents, in the following order.
 - .2 Manufacturer's literature describing each piece of equipment and giving manufacturer's model number and drawing number.
 - .3 Copies of all warranties on equipment supplied to the project. For each item of work defined in this specification, provided with a warranty.
 - .4 Copies of all approved installation procedures.
 - .5 Copies of all assembly, erection and shop drawings. These drawings to be included "as built" in the final version of the manual.
 - .6 Steps for cursory inspection that should be carried out annually.
 - .7 Steps for semi-in-depth inspection that should be carried out every three (3) years.
 - .8 Steps for in-depth inspection that should be carried out every six (6) years.
 - .9 List of nearest local suppliers of all equipment parts.
 - .10 List of parts and supplies that are to be furnished as part of the Contract.
 - .11 Name, address, and telephone number of the local manufacturer's representative and of the service company for each piece of equipment so that prices or spare parts can easily be obtained.
 - .12 Copies of hydraulic cylinder pressure strip chart recordings or data acquisition printouts made during start up testing.
- .2 Submit six (6) preliminary copies of the manual prior to shipment of machinery to the site. Complete the preliminary manual in all respects regarding material content, organization and legibility for review by the Departmental Representative. Preliminary copies need not comply with presentation requirements including
-

- page size, paper weight, paper reinforcement and protection including oil, moisture and wear resistant covers, and copy method.
- .3 Preliminary copies will be reviewed, and the changes made will be incorporated into the final manual. Submit six (6) final copies of the manual after the machinery is in operation. Incorporate into the final manual the Departmental Representative's comments on the preliminary manual and all field changes made during construction and installation. Ensure permanence of the manuals by complying with all presentation requirements.
 - .4 Provide an electronic copy of the final manual in Portable Document Format (PDF). The PDF file shall be indexed to match the hard copy manual and shall allow navigation to all sections and subsections by clicking on the topic in the index.
 - .5 Furnish manufacturer's operating and maintenance manuals giving complete instructions relative to assembly, installation, operation, adjustment, lubrication, maintenance, and carrying complete parts lists for every item of equipment furnished by the Contractor.
 - .6 Manuals may be manufacturer's standard publications if they comply with specified requirements relative to quantity and quality of information and data.
 - .7 Neatly imprint the covers and title page with a descriptive title and that contain the name of the bridge, owner, and location. Include on the title page the names of the Departmental Representative, the Contractor, and the date of issue. Separate the various sections which comprise the manual with divider pages. All parts information must be correct for the equipment provided under this Contract. Modify standard parts drawings to be suitable and block out irrelevant material. Modify all general information used as necessary to show pertinence to the equipment furnished under this Contract and remove irrelevant material. Submit the arrangement of the manual, method of binding, including material and text to the Departmental Representative for approval.
 - .8 Illustrations must be clear. Printed matter, including dimensions and lettering on drawings, must be easily legible. If reduced drawings are incorporated into the manuals, darken the original lines and letters if necessary, to retain their legibility after reduction. Larger drawings may fold into manuals to page size. Reproduce diagrams and prints used in the manual
-

to a size less than 279 mm by 432 mm. Include diagrams on white paper and vacuum seal in transparent plastic material impervious to moisture and oil, and resistant to abrasion. Other formats which are equal in clarity, sharpness, durability and permanence will be considered.

- .9 Prepare the manuals from the following materials:
 - .1 Tear, water, and grease resistant paper.
 - .2 Page size, 216 mm by 279 mm
 - .3 Fold out diagrams and illustrations.
 - .4 Reproducible by dry copy xerography method.
 - .5 Oil, moisture and wear resistant hard or flexible plastic covers.
- .10 Furnish a minimum of one (1) hydraulic schematic for the system. Produce the schematic on a 559 mm by 864 mm sheet. Submit the schematic to the Departmental Representative for approval and mount the approved chart in a watertight frame. Mount the schematic in the Parks Building near the hydraulic power unit or as directed by the Department Representative.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND WORKMANSHIP

- .1 All materials shall be new and conform to NFPA standards and other standards listed in these Specifications and on the Contract Drawings, unless noted otherwise.
- .2 Supply materials from manufacturers who have manufactured similar materials for similar applications for a period of not less than ten (10) years.
- .3 Do not fabricate, machine, weld, cast or forge items without sufficient advance notification to the Departmental Representative to permit scheduling of required inspection. Furnish all facilities and provide for free access at the plant or shop for the inspection of materials and workmanship, and to witness shop tests. The inspector has the authority to recommend to the Departmental Representative rejection of material or workmanship that does not meet the requirements of the Contract Documents. The Departmental Representative shall make the final decision for rejection.

2.2 FASTENERS

- .1 Bolts smaller than 1 1/2 in. (38 mm): high strength heavy hex bolts made from material equal to ASTM A325M unless otherwise specified on the Contract Drawings.
 - .2 Bolts greater than 1 1/2 in. (38 mm): made from material equal to ASTM A449-07b.
-

- .3 All bolts: conform to the Unified Thread Standards, coarse thread series, for threads on bolts, nuts, and cap screws with a Class 2A tolerance for bolts and Class 2B tolerance for nuts, in accordance with ANSI/ASME B1.1_2003, unless otherwise specified. Bolt head and nut bearing surface must be flat and square with the axis of the bolt holes. Spot face as necessary to produce no less than 80% contact between mating surfaces.
 - .4 Turned bolts are called out by nominal thread diameter on the Contract Drawings. The bodies of turned bolts shall be 63 micro-inch finish or finer, and as defined by CHBDC 13.8.17.8, unless noted otherwise on the Contract Drawings. Turned bolt body diameters shall be 1.6 mm larger than thread diameter. Turned bolt heads shall be standard hex for bolts of the next nominal size larger than the thread diameter or heavy hex for nominal thread diameter, unless noted otherwise on the Contract Drawings. Unless otherwise noted, bolt holes in machinery parts required for connecting to supporting steel may be sub-drilled (in the shop) smaller than the turned bolt diameter and shall be reamed together with supporting structural steel either during assembly or at erection to provide an LC6 fit, after the parts are correctly assembled and aligned.
 - .5 Hex sockethead cap screws: ASTM A574-08.
 - .6 Hex socket flat countersunk head cap screws: ASTM F835-04e1.
 - .7 Stainless steel hex cap screws ASTM F593-02 (2008). All fasteners and anchor bolts in contact with concrete shall meet this requirement. All fasteners for piping, tubing and electrical work in trench shall meet this requirement. All fasteners for equipment mounting in HPU shall meet this requirement. All nuts and washers shall be stainless steel material complementary to this requirement.
 - .8 Hex cap screws ASTM A449-07b
 - .9 Lock Washers: ASME B18.21.1-2009
 - .10 Brass hex socket flat countersunk head cap screws: ASTM F468-06e1
 - .11 Furnish positive type lock nuts and hardened washers for all bolts and for all flat countersunk head cap screws used as bolts. Double heavy hex nuts conforming to ASTM A563-07a are required unless indicated otherwise on the Contract Drawings. Submit alternate locking methods to the Departmental Representative for
-

approval. All hardened steel washers: in accordance with ASTM F436-09.

- .12 Tighten fasteners to provide a tension of 50% of the bolt's ultimate tensile strength unless otherwise specified on the drawings. Provide the method of tightening and of verifying the tension in all bolts on the Shop Drawings for approval by the Departmental Representative.

2.3 ENCLOSURE

- .1 Contractor shall provide and install a waterproof enclosure for the hydraulic power unit (HPU) and associated electrical components. The enclosure shall be used to fully enclose, protect and secure the HPU and associated electrical components. Contractor shall coordinate between the HPU and enclosure suppliers to allow proper installation of units while maintaining enclosure and component warranties. The enclosure shall include doors and readily removable wall/roof panels large enough to install or remove HPU without disassembly. Enclosure shall meet the following minimum requirements and be made up of, but not limited to, the following components:
 - .1 Exterior features
 - .1 Walls - formed panels with minimum 12-gauge stainless steel in accordance with ASTM A666. To be stitch welded and caulked before painting.
 - .2 Doors - formed panels with minimum 12-gauge stainless steel in accordance with ASTM A666. To be stitch welded and caulked before painting.
 - .3 Roof - formed panels with minimum 12-gauge stainless steel in accordance with ASTM A666. To be stitch welded and caulked before painting. Roof shall have a 50mm (2") slope away from the operator house.
 - .4 Enclosure shall surround HPU on four sides and shall rest on concrete pad. Note that pad will be sloped away from operator house and walls shall be sloped to match so enclosure corners are plumb. Enclosure walls may be secured to HPU frame or directly to concrete pad using tabs and anchor bolts.
 - .5 Manufacturer's nameplate with serial number located outside near front door.
 - .6 Lifting lugs for enclosure per manufacturer's recommendations.
 - .7 Two grounding pigtailed located below the floor.
 - .8 Contractor to coordinate anchorage to foundation.
 - .9 Contractor shall coordinate arrangement of HPU and enclosure to assure easy

access to all locations requiring regular maintenance. This includes access to valving, temperature, fluid level and pressure gauges, filters and filling/draining of fluid. The reservoir cleanout cover shall be easily accessible by either a door or removable wall section.

- .2 Doors
 - .1 Vandal resistant bolt on stainless steel hinges with grease fittings and stainless-steel pins.
 - .2 Heavy duty two-point locking system with interior safety override handle.
 - .3 Door constructed of exterior and interior metal skin with 50mm (2") of insulation between.
 - .4 Stainless steel prop rod(s) to hold door open at 90 degrees and 160 degrees, +/- 5 degrees.
 - .5 EPDM extruded rubber gasket(s) providing weather tight seal.
 - .3 Interior features
 - .1 Roof, wall(s), door(s) and floor minimum R value=11.
 - .2 Contractor to coordinate entries for electrical and hydraulic tubing.
 - .4 HVAC
 - .1 Exhaust vent with stainless steel bird mesh at opening(s) and rainproof gravity operated louvers. Vent shall be sized to satisfy air exchange requirements for enclosure as required to remove heat generated by HPU during summer months.
 - .2 One 120 volt, 60 hertz, ventilation fan. Provide gravity operated shutter constructed of stainless steel with felt seals on leading edges of blades.
 - .3 One thermostat for ventilation control - 1 to 43°C (30 to 110°F) operating range.
 - .5 Electrical
 - .1 Refer to electrical section for required additional electrical component requirements.
 - .6 Quality control, testing, and project managing
 - .1 Structural design by or reviewed and approved by, Structural P.Eng licensed in Ontario.
 - .2 Mechanical and Electrical final installation to be inspected by manufacturer In-house Project Manager.
 - .3 Manufacturer to provide QC/QA Inspection reports at completion of fabrication of unit. Provide applicable certification documentation per project provisions.
-

- .2 Installation requires coordination with new foundation and existing trench modifications.

2.4 HYDRAULIC SYSTEM

.1 HYDRAULIC POWER UNIT

- .1 Tank/Reservoir - (1.1) Custom reservoir with integral skid and containment tray. Provide oil and temperature gage, cover mounting bolts, a ½ inch (12.7 mm) ball valve drain with plug (1.3 and 1.26), channel gasket for cover plate seal, Type 316 stainless steel construction with removable top covers and clean out access points on side for maintenance personnel access, 100-gallon (455 liter) capacity. Provide ports for all accessories indicated on drawing M12 schematic. Containment tray shall be sized accordingly to hold minimum 120% tank capacity.
- .2 Pump Suction Strainer - (1.2) Spin-on canister, Mesh #60 with 4.5 psi bypass. 50 Gallon/min (190 L/min) minimum flow rate. Provide visual indicator gauges on pressure and vacuum. Pump suction shall be connected so as to always be below fluid level in reservoir.
- .3 Plug - (1.3) High pressure brass plug 1-inch (25mm) NPT external hex.
- .4 Test Port - (1.4) Leak proof test port connection. M16x2 thread male. 5000 psi (340 bar) pressure rating.
- .5 Hydraulic Pump/Motor/Coupling - (1.5, 1.6, 1.7 and 1.8)
 - .1 Pump: Axial Piston Variable Displacement with Horsepower Limiting Control, 8.5 cu in/rev (140 cc/rev) displacement, 3600 psi (250 bar) minimum pressure rating.
 - .2 Prime Mover: 25 HP @1800 RPM Standard Frame 284TC, TEFC/NEMA "B" faced electric motor coupled with a "D" faced adaptor bracket.
 - .3 Coupling: Flexible installed with less than 0.003" misalignment and coupling setscrews secured with Loctite.
 - .4 Adaptor Bracket: Standard aluminum adaptor bracket with access hatch for coupling inspection and maintenance. Bracket shall assure concentricity between motor shaft and pump shaft to within less than 0.003".
 - .5 Stainless steel support to be provided for motor/pump assembly. Provide means to easily remove and install assemblies onto the HPU integral skid. Motor, coupling, and pump assemblies shall be mounted above the highest point of the containment tray and shall be located so

- pump inlet is always lower than fluid level in reservoir.
- .6 High Pressure Hoses - (1.9 & 1.10) 1 1/4" inch ID high pressure hose, 4000 psi (276 bar) minimum working pressure rating.
 - .7 Dual Pressure Switch - (1.11) Adjustable range 30 - 4000 psi (276 bar), repeatability 3% of setting.
 - .8 Pressure Gauge - (1.12) 0 - 5000 psi (0-345 bar), Bourdon tube type, liquid filled, stainless steel case, 2.5-inch (63 mm) dia. face.
 - .9 Return Line Filter - (1.13) 50 Gallon/min (190 L/min) minimum rated flow capacity, equipped with electrical clogging indicator and clogged element bypass. Filter element shall be rated at 10 microns absolute.
 - .10 Oil Flow Diffuser - (1.14) 50 Gallon/min (190 L/min) minimum flow rate.
 - .11 In-Tank Magnet - (1.15) Magnet Trap Rod w/2-inch NTP plug end.
 - .12 In Tank Float Switch - (1.16) Dual switches for low fluid warning and low fluid shut off. Adjustable.
 - .13 Filler Cap - (1.17) 2-inch Cap with coarse strainer for direct filling of reservoir.
 - .14 Site Glass/Thermometer - (1.18) O-ring seals, Pyrex glass tube, aluminum body, bimetal type, 127 mm stainless steel case, range -20 to 120 degrees C, accuracy +/- 1.0% full scale.
 - .15 Not Used - (1.19)
 - .16 Desiccant Filter - (1.20) Silica gel breather. 3-micron filtration. Operating temperature -20 degree F to 200 degree F. Flow rate 26 cfm @ 1psid.
 - .17 Not Used - (1.21)
 - .18 Control Panel - (1.22) per electrical section.
 - .19 Temp Switch - (1.23 and 1.24) dual temperature switch with bulb well. Temp Range 10-300 degrees F (-12 to 149 degrees C)
 - .20 Immersion Heater with Bulbwell - (1.25) 2-2kW heaters, screw in type with bulbwell. Heaters shall have sufficient surface area and heat density to prevent overheating fluid in direct contact with heaters.
 - .21 Drain Ball Valve - (1.26) 1inch (25 mm) ball valve with 600 psi (41 bar) pressure rating.
 - .22 Check Valve - (1.28) minimum flow rate of 50 Gallon/min (190 L/min), minimum pressure rating of 4000 psi (276 bar).
 - .23 Quick Disconnect Coupling - (1.29) Provide stainless steel nipple connections. (Reference: Nipple H3-63). Note couplings to mate with Parks portable HPU fittings.
-

- .24 Pressure Filter - (1.30) Operating pressure 4000 psi (276 bar), 50 Gallon/min (190 L/min) minimum flow rate, equipped with electrical clogging indicator and clogged element bypass. Filter element shall be rated at 20 microns absolute.
 - .25 Pilot and Solenoid Operated Pressure Relief Valve - (1.31 to 1.34) Relief Valve, sub-plate mounted, 70 gal/min (265 L/min) nominal capacity, 3000 psi (204 bar) pressure rating. Valve shall be inversely proportional type such that as the command signal increases the pressure decreases. Valve shall default to full pressure setting whenever power is disconnected or there is no command signal.
 - .26 Not Used - (1.35)
 - .27 Not Used - (1.36)
 - .28 Not Used - (1.37)
 - .29 Check Valve - (1.38) Spring check valve with 45 psi cracking pressure.
 - .30 Not Used - (1.39 to 1.42)
 - .31 Proportional Flow Control Valve with 24VDC Control - (1.43) Pilot operated, normally closed, electro-proportional throttle valve with reverse flow check. External drain, 60 Gal/min (190 L/min) max capacity. 3000 psi (2046 bar) minimum pressure rating, custom assembled.
 - .32 Solenoid Operated Directional Control Valve - (1.44) Three Position, Float Center, with external drain, 40 Gal/min (152 L/min) max capacity. 3000 psi (204 bar) minimum pressure rating.
 - .33 Flow Control/Needle Valve - (1.45) Adjustable needle valve - for speed control. Minimum pressure rating of 3000 psi (204 bar). Valve characteristics shall complement connected function to allow accurate and repeatable setting of full stroke speed within the range of two to ten seconds.
 - .34 Check Valve - (1.46) minimum flow rate of 10 Gal/min (7 liter/min), minimum pressure rating of 4000 psi (276 bar).
 - .35 Relief Valve - (1.47) Adjustable range 30 - 3000 psi (2-204 bar), 10 gal/min nominal capacity, 4600 psi (312 bar) pressure rating.
 - .36 Main System Manifold (1.50): As shown in the Contract Drawings. The main system manifold shall be designed for a minimum pressure rating of 3500 psi (238 bar) and fabricated from ductile iron or steel. The main system manifold shall house pressure relief valves, directional control valves, needle type flow control valves, test ports and all other accessories as shown in the Contract
-

Drawings. The main system manifold shall be hydrostatically tested to 4500 psi (306 bar) prior to final assembly in the system.

- .2 SPAN DRIVE BRIDGE CYLINDER ASSEMBLY
 - .1 Main Cylinder - (2.1) Refer to drawing M4 and M12 for additional requirements.
 - .2 Main Cylinder Manifold - (2.2) Flange mount to main cylinders bore side. Provide stainless steel tubing to annular side.
 - .3 Test Port - (2.3) Leak proof test port connection. Coordinate with cylinder manufacturer. 4000 psi (276 bar) pressure rating. Locate to allow bleeding of cylinders in installed positions.
 - .4 Not Used - (2.4)
 - .5 Counterbalance Valve - (2.5) 4 port counterbalance valve, vented, pilot ratio 3:1, maximum setting 3000 psi (204 bar). Tamper proof valves.
 - .6 Flow Control/Needle Valve - (2.6) Adjustable needle valve - for manual operation speed control. Minimum pressure rating of 3000 psi (204 bar).
 - .7 Not Used - (2.7)
 - .8 High Pressure Hoses - (2.8) 1 1/4" inch high pressure hose, 4000 psi (276 bar) minimum working pressure rating.
 - .9 Ball Valve - (2.9) High pressure full port ball valve SAE 316SS Body and Trim. Valves capable of being locked with a padlock in open and closed positions.
 - .10 Stainless Steel Tubing Pressure Side - (2.10 & 2.11) 1.25 inch diameter by 0.120 inch wall. Refer to Section 2.5 for additional requirements.
 - .11 Stainless Steel Tubing Return Side - (2.12) 1.25 inch diameter by 0.083 inch wall. Refer to Section 2.6 for additional requirements.
 - .3 SPAN LOCK CYLINDER ASSEMBLY
 - .1 Span Lock Cylinder - (3.1) Refer to drawing M10 and M12 for cylinder requirements.
 - .2 Not Used - (3.2)
 - .3 Test Port - (3.3) Leak proof test port connection. Coordinate with cylinder manufacturer. 5000 psi (340 bar) pressure rating. Locate to allow bleeding with cylinder in installed position.
 - .4 High Pressure Hoses - (3.4) 3/4" inch high pressure hose, 3000 psi (204 bar) minimum working pressure rating.
 - .5 Ball Valve - (3.5) High pressure full port ball valve SAE 316SS Body and Trim. Valves capable of being locked with a padlock in open and closed positions.
-

- .6 Stainless Steel Tubing - (3.6 & 3.7) 0.750 inch by 0.065 inch wall. Refer to Section 2.6 for additional requirements.
 - .4 END LIFT CYLINDER ASSEMBLY
 - .1 End Lift Cylinder - (4.1) Refer to drawing M9 and M12 for cylinder requirements.
 - .2 End Lift Cylinder Manifold - (4.2) Flange mounted to cylinder. Provide counterbalance cartridge valves, 4 port, vented, 4000 psi (280 bar) max setting, pilot ratio 3:1.
 - .3 Test Port - (4.3) Leak proof test port connection. Coordinate with cylinder manufacturer. 5000 psi (340 bar) pressure rating. Locate to allow bleeding with cylinder in installed position.
 - .4 Not Used - (4.4)
 - .5 High Pressure Hoses - (4.4) 3/4" inch high pressure hose, 3000 psi (204 bar) minimum working pressure rating.
 - .6 Ball Valve - (4.5) High pressure full port ball valve SAE 316SS Body and Trim. Valves capable of being locked with a padlock in open and closed positions.
 - .7 Stainless Steel Tubing - (4.6 & 4.7) 0.750 inch by 0.065 inch wall. Refer to Section 2.6 for additional requirements.
 - 2.5 VALVES (GENERAL)
 - .1 All system valving shall be rated for its intended flow and pressure with a minimum pressure rating of 3000 psi (204 bar) on all pressure valves. Use ANSI standard sub plate mounted valves for ease of servicing, wherever possible.
 - .2 Ball valves shall be stainless steel with a minimum working pressure rating of 3000 psi (204 bar) and a 4 to 1 safety factor against burst.
 - 2.6 PIPING, FITTINGS
MANIFOLDS
 - .1 Piping includes all pipe, tubing and flexible hose. Piping, fittings, manifolds and the piping system shall conform to CSA Standards, except as otherwise noted. All rigid plumbing, field or local to HPU's, shall be seamless type 316 stainless steel tubing or pipe. All fittings shall be 37-degree O-ring seal, Type 316 stainless steel. Use SAE straight thread connections wherever possible. Pipe threads shall not be permitted on the hydraulic system without prior written permission from the Departmental Representative. Do not permit installed piping to come into direct contact with metal or concrete structures and protect piping from abrasion. Use vibration damping clamps suitable for piping under 3000 psi (204bar) pressure with Type 316 stainless steel hardware and plates to support piping.
-

- .2 Flexible hoses and Fittings shall be SAE rated for intended working pressures with a minimum working pressure rating of 3000 psi (204 bar) with a minimum safety factor of 4:1. Hose ends shall be 37 degree FJICS manufactured from Type 316 stainless steel and shall be crimped. Use flexible hoses on cylinder connections and anywhere on the HPU where vibration or movement may unreasonably reduce the working life of rigid plumbing connections. Protective sleeves shall be used to protect hoses from abrasion due to contact with hose supports, the structure, other hoses or adjacent equipment. The material to be used shall be submitted for approval. Hoses shall be run in a manner which allows full range of movement without unduly stressing the connections and in such a way to help reduce noise.
- .3 All manifolds shall conform to CSA Standards.
- .4 Test port adapter fittings shall be of the checked female type, be provided with a metal cap that is tethered to the fitting. Fitting, cap and tether Type 316 stainless steel.
- .5 Piping supports shall be of Type 316 stainless steel construction. Vibration-damping strut mount clamps shall be utilized to support tubing. Stainless steel anchors shall be utilized to anchor supports to masonry. Supports to be spaced in accordance with ISO 4413:2010.

2.7 HYDRAULIC CYLINDERS

- .1 Hydraulic cylinders shall be NFPA industrial mill duty type. Cylinders shall meet all applicable NFPA standards. The pressure rating of all cylinders shall be 3000 psi (207 bar) minimum. Cylinders shall have bore diameter, rod diameter and stroke as indicated on the Contract Drawings.
 - .2 Cylinder Mounts: End mountings with spherical end bearings and pins as shown.
 - .3 Cylinder Heads and Caps: The cylinder head and caps shall be bolted to the cylinder body. Rod bearing, seals and wipers shall be easily replaceable without disassembly of the rod end connections.
 - .4 Piston Rods: Piston rods shall be made of 17-4 PH stainless steel.
 - .5 Seals: Seal material shall be compatible with the hydraulic fluid in use. A metallic rod wiper shall be provided. The manufacturer shall produce evidence that all dynamic seals are suitable for both frequent and infrequent operation and are capable of not less than 500,000 cycles of operation.
-

- .6 Cylinder Manifolds (2.1): As shown in the Contract Drawings. The cylinder manifold shall be designed for a minimum pressure rating of 3500 psi (238 bar) and fabricated from ductile iron or steel. The manifold shall house pressure relief valves, directional control valves, needle type flow control valves, test ports and all other accessories as shown in the Contract Drawings. The manifold shall be hydrostatically tested to 4500 psi (306 bar) prior to final assembly in the system pressure.
- .7 Cylinder Ports: Cylinder ports shall be SAE four bolt "O" ring type.
- .8 Cylinders shall be painted using the manufacturer's special paint for corrosive marine environments.
- .9 Testing: Hydraulic cylinders shall be hydrostatically tested at 4500 psi (306 bar) for 15 minutes in both directions. After the test, the cylinder shall be inspected for deformation, seal leakage or other failures. After the hydrostatic test, the cylinder shall be fully extended and retracted for a minimum of 25 cycles. Cylinder motion must be smooth, and no leakage is permitted. If corrective action is necessary, the testing sequence shall be performed again. Testing shall be coordinated so that all cylinders for the project can be tested at the same time. Use the specified hydraulic fluid for all testing.

2.8 SPARE PARTS

- .1 General
 - .1 Two (2) seal kits for each cylinder type.
 - .2 Four (4) replacement elements for each type of filter/strainer type.
- .2 Span Drive Cylinder Assembly - one (1) span drive hydraulic cylinder with spherical bearings.
- .3 End Lift Assembly - one (1) end lift hydraulic cylinder with spherical bearings.
- .4 Span Lock Assembly - one (1) span lock hydraulic cylinder with spherical bearings.
- .5 Hydraulic Power Unit - six (6) reservoir breathers, two (4) filter elements for each filter type and one (1) electric motor.
- .6 Refer to Section 29 05 00 of these specifications for mechanical spare parts.

Note: System shall be turned over with new filter elements in all filters and complete quantity of spare filter elements turned over to the owner.

PART 3 - EXECUTION

- 3.1 FIELD MEASURING .1 Prior to fabricating new machinery components, field survey and measure the existing bridge site, as required, ensuring that the replacement components and other system modifications as shown on the Contract Drawings will fit within their designated locations. Perform all such surveys and measurements before preparation of the shop drawings. The Contractor is responsible to ensure the field measurement and shop drawing accuracy is sufficient to eliminate errors in installation, fit and function.
- 3.2 CONSTRUCTION DETAILS .1 Supply all apparatus, tools, devices, materials and labour to manufacture, ship, install, erect, align, adjust, lubricate, test, and paint, to complete machinery as provided in the Contract Documents. Furnish any apparatus, tools, devices, materials and labour incidental to the work, but not specifically stated or included at no additional cost.
- 3.3 QUALITY .1 Products, materials, equipment and articles incorporated in Work shall be new (unless specified otherwise in the contract documents), not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Contractor shall remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should disputes arise as to quality or fitness of products, decision rests strictly with the Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any or like item throughout.
- 3.4 INSPECTION .1 The Departmental Representative reserves the right to inspect all machinery at the factory prior to shipping. Provide the Department Representative with full access to the manufacturer's fabrication facility for such inspections.
- .2 Inspections are based on the requirements of the Specifications and Contract Drawings, referenced
-

codes or standards, and the Contractor's approved submittal documents. The Departmental Representative has the authority to stop fabrication or shipment of any material, component, or assembly that does not comply with specified requirements. Replace or repair to the satisfaction of the Departmental Representative any such rejected item. All such replacements or repairs are made at the Contractor's expense.

- .3 The Department Representatives will make inspections of equipment throughout the construction period. Correct defects, deficiencies, or deviations from the Contract Drawings or Specifications discovered during such inspections at no additional cost. Shop approval of machinery does not relieve the Contractor from making such repairs as directed by the Departmental Representative.

3.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

3.6 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Coat finished metal surfaces and unpainted metal surfaces that would be damaged by corrosion, as soon as practical after finishing with a corrosion inhibitor. Remove this coating from all surfaces prior to lubrication for operation and from all surfaces prior to painting after erection.
- .3 Mount assembled units on skids or otherwise crate for protection from weather, dirt and all other injurious conditions during shipment and storage as approved by the machinery manufacturer. Submit in advance information as to methods and materials which will be used for protection for approval by the Departmental Representative.
- .4 Store machinery items as to permit easy access for inspection and identification. No outdoor storage of machinery components is permitted regardless of the methods of protection provided.
- .5 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

- .6 Store products subject to damage from weather in weatherproof enclosures.
- .7 Store cementitious products clear of earth or concrete floors, and away from walls.
- .8 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .9 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .10 Correct damage that occurs to the machinery components because of improper protection during shipment or storage by the Contractor to the satisfaction of the Departmental Representative at no additional cost.
- .11 Touch-up damaged factory finished surfaces to the Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

3.7 MANUFACTURERS
INSTRUCTIONS

- .1 Unless otherwise indicated in specifications install, assemble or erect products in accordance with manufacturer's instructions.
- .2 Notify the Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that the Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and reinstallation at no increase in Contract Price or Contract Time.

3.8 INSTALLATION

- .1 Commence demolition of existing components after the navigation closure begins, and after all required components have been manufactured and approved for installation, preparations by others where required have been satisfactorily completed and installation procedure have been approved.
 - .2 All hydraulic connections, system flushing and start up shall be performed under the direction of a Certified Fluid Power Technician whose certification number shall be listed on the resume submitted for approval.
-

3.9 FILLING AND
FLUSHING OR HYDRAULIC
SYSTEMS

- .1 Prior to connecting piping or flexible hoses to any system component, clean with a pneumatically powered projectile cleaning system repeating until a fresh clean projectile exists with no visible debris.
- .2 After completion of work on any hydraulic system, the system shall be topped off with new hydraulic fluid. Any fluid that is drained from the system in order to perform the work shall be removed and properly disposed of in accordance with all applicable local, provincial and federal laws.
- .3 Any hydraulic fluid that is added to the system shall be pumped into the reservoir through a 10-micron filter.
- .4 All components of the affected systems (pumps, valves, manifolds, supply and return lines, reservoirs, etc.) shall be thoroughly flushed by looping hoses at the cylinders. The main pump may be used for flushing. All system filter elements shall be replaced as required during flushing and new filter elements shall be installed at the end of the flushing. A suitable portable filtration unit may also be used. Flushing for all systems shall be continued until a particle count below 18/16/13 per ISO 4406 (NAS 7) is achieved for two consecutive contamination tests. A certified laboratory fluid analysis/report shall confirm that the required range has been achieved and that there is an acceptable level of water in each system. Copies of the certified laboratory reports shall be submitted to the Departmental Representative. Flushing shall be performed under the direction of a Certified Fluid Power Technician.

3.10 START UP AND
FUNCTIONAL CHECKOUT

- .1 The Contractor shall install, test and make field adjustments to the hydraulic system to get the system up and running. The Contractor shall perform a detailed functional checkout of the hydraulic operating system after completing the field adjustments. A detailed final functional checkout procedure (sealed by a Professional Engineer licensed in Ontario, Canada) shall be developed by the Contractor and submitted to the Departmental Representative for review and approval at least six (6) weeks prior to scheduling the functional checkout of the completed system.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
.1 General requirements that are common to NMS sections found in Division 26 - Electrical.
- 1.2 RELATED REQUIREMENTS .1 26 05 20 - Wire And Box Connectors (0-1000 V)
.2 26 05 21 - Wires And Cables (0-1000 V)
.3 26 05 22 - Connectors And Terminations
.4 26 05 29 - Hangers And Supports For Electrical Systems
.5 26 05 31 - Splitters, Junction, Pull Boxes And Cabinets
.6 26 05 32 - Outlet Boxes, Conduit Boxes And Fittings
.7 26 05 34 - Conduits, Conduit Fastenings And Conduit Fittings
.8 26 24 16 - Panelboards: Breaker Type
.9 26 24 19 - Power Distribution Panel And Miscellaneous Electrical Work
.10 26 24 21 - Operator Control Station
.11 26 27 16 - Electrical Cabinets And Enclosures
.12 26 56 20 - Navigation Lights
.13 26 56 21 - Traffic Gates
.14 26 56 22 - Traffic Lights
.15 02 41 13 - Selective Site Demolition
- 1.2 REFERENCES .1 Definitions:
.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
.2 Reference Standards:
.1 Canadian Standards Association (CSA International)
.1 CSA-C22.1-2018 and amendments thereto, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
.2 CSA C22.2 No. Not applicable.
-

- .3 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .4 Do underground systems in accordance with CSA C22.3 No.7-06, Underground Systems, except where specified otherwise.
 - .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958 and amendments thereto, Light Gray Colour for Indoor Switch Gear.
 - .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .4 The Ontario Electrical Safety Code 2009, and all bulletins (Ontario).
 - .5 Hydro requirements and local applicable codes and regulations.
 - 1.3 ACTION AND INFORMATIONAL SUBMITTALS
 - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all new electrical components and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit for review single line electrical diagrams under plexiglass and locate on wall adjacent to motor control centre.
 - .4 Shop drawings:
 - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 Submit three (3) of copies of 600 x 600 mm minimum size drawings and product data to PWGSC.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.
 - .5 Certificates:
 - .1 Provide CSA certified equipment and material.
-

- .2 Where CSA certified equipment and material is not available, submit such equipment and material to Departmental Representative for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
 - .6 Manufacturer's Field Reports: submit to Departmental Representative, manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- 1.4 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for complete movable span electrical and mechanical systems for incorporation into manual.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
 - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
 - .4 Post instructions where directed.
 - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
 - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.
-

- .7 Provide final as-built drawings noting all work performed for incorporation into manual.
- .8 Provide an Arc Flash Risk Assessment (AFRA) for the new power distribution equipment provided under this contract. Use the actual approved and installed equipment provided under this Contract. Use the final as-built settings for all circuit breakers and protection devices to determine the AFRA and generate the Arc Flash Labels for all equipment rated 50V or higher. Provide vinyl arc flash labels on all equipment.

1.5 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
 - .1 In accordance with Section 01 31 19.
 - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, in appropriate NMS Section 01 45 00, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE
AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .4 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .5 Storage and Handling Requirements:

- .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect all new equipment from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

1.7 SYSTEM STARTUP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .6 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .7 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.8 DELIVERY, STORAGE
AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect all new equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

- 2.2 MATERIALS AND EQUIPMENT
- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from PWGSC before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .3 Factory assemble control panels and component assemblies.
- 2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS
- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- 2.4 WARNING SIGNS
- .1 Warning Signs: in accordance with requirements of PWGSC and Departmental Representative.
 - .2 Porcelain enamel, minimum size 175 x 250 mm.
- 2.5 WIRING TERMINATIONS
- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.
- 2.6 EQUIPMENT IDENTIFICATION
- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets, transformers, relay panels, control consoles, motor control centers, and junction boxes shall identify the

panel name and alphanumeric identifier, indicate system and voltage characteristics. Identify the power source to the panel, to clearly identify how to de-energize the panel. If there are multiple power sources provide a nameplate identifying multiple power sources to the panel and identify each power source.

- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. XXXX" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage. Identify the power source to the equipment, to clearly identify how to de-energize the equipment. If there are multiple power sources provide a nameplate identifying multiple power sources to the panel and identify each power source.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

- 2.9 FINISHES
- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish, except for stainless steel components.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
 - .2 Commence demolition of existing components after the navigation closure begins, and after all required components have been manufactured and approved for installation, preparations by others where required have been satisfactorily completed and installation procedure have been approved.
 - .3 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.
- 3.2 NAMEPLATES AND LABELS
- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.
- 3.3 CONDUIT AND CABLE INSTALLATION
- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: plastic sized for free passage of conduit, and protruding 50 mm.
 - .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
 - .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.
- 3.4 LOCATION OF OUTLETS
- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
 - .4 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
 - .5 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
 - .6 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.
-

-
- 3.5 MOUNTING HEIGHTS
- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
 - .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
 - .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
- 3.6 CO-ORDINATION OF PROTECTIVE DEVICES
- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- 3.7 FIELD QUALITY CONTROL
- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
 - .4 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
-

- .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
 - .5 Carry out tests in presence of Departmental Representative.
 - .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .7 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- 3.8 SYSTEM STARTUP
- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
 - .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
 - .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
- 3.9 CLEANING
- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
 - .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 -GENERAL

- 1.1 SECTION INCLUDES .1 Material and installation for wire and box connectors.
- 1.2 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results For Electrical.
- 1.3 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CAN/CSA-C22.2 No.18-[98(R2003)], Outlet Boxes, Conduit Boxes and Fittings.
.2 CAN/CSA-C22.2 No.65-[03(R2008)], Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
.2 National Electrical Manufacturers Association (NEMA)
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.5 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.
- 1.6 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
 - .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
 - .3 Bushing stud connectors to consist of:
 - .1 Connector body and stud clamp for stranded round copper conductors.
 - .2 Clamp for stranded round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
 - .4 Clamps or connectors for armoured cable, TECK cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Remove insulation carefully from ends of conductors and cables and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 - GENERAL

- 1.1 PRODUCT DATA .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- 1.2 DELIVERY, STORAGE AND HANDLING .1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 BUILDING WIRES .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, RWU90 XLPE, Jacketted.
- .3 Copper conductors: size as indicated, with thermosetting plastic insulation type XLPE rated at 600 V.
- .4 Neutral supported cable: 1 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NSF-2 flame retardant rated 600 V.
- 2.2 TECK 90 CABLE .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
.1 Grounding conductor: copper.
.2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
.1 Cross-linked polyethylene XLPE.
.2 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
.1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
.2 Channel type supports for two or more cables at 500 mm centers.
.3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
.1 Watertight approved for TECK cable.

- 2.3 FLEXIBLE CABLES (TO MOVABLE SPAN)
- .1 All control wiring and power for span navigation lights shall be routed to the movable span via Type SOOW, Class K stranded, neoprene-sheathed, flexible cables. Flexible cables shall be provided with strain relief fittings and basket weave cable grips at each end. Strain relief fittings shall be malleable iron, liquid tight strain relief fittings. The cable grips shall be stainless steel, heavy long, closed wire mesh, single weave with a double eye support. All mounting hardware shall be stainless steel. Flexible cables shall be Cordaflex(K) by Prysmian Cables and Systems (distributed by Anixter Cable Co.) or equal.

PART 3 - EXECUTION

- 3.1 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
 - .3 Perform tests before energizing electrical system.
- 3.2 GENERAL CABLE INSTALLATION
- .1 Install cable in trenches in accordance with CAN/CSA A23.1.
 - .2 Lay cable in cable trays individually. Use rollers when necessary to pull cables. Secure cables in cabletrough at 6m centres, with nylon ties. Identify cables every 30m with nameplates.
 - .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
 - .4 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
 - .5 Conductor length for parallel feeders to be identical.
 - .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
 - .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
 - .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and
-

electronic equipment to be 2-wire circuits only,
i.e. common neutrals not permitted.

- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF
BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF
TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps and hangers.
- .3 When installed in PVC conduit the Contractor shall field verify the requirements of CSA C12.902(2) for the calculated pulling tension and calculated maximum sidewall bearing pressure. The Contractor shall coordinate all new PVC conduit installations for TECK90 cable that it will conform to the requirements of CSA C12.902(2) for the calculated pulling tension and calculated maximum sidewall bearing pressure.

3.5 INSTALLATION OF
ARMOURED CABLES

- .1 Group cables wherever possible on channels.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and installation for connectors and terminations.
- 1.2 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- 1.3 REFERENCES .1 Canadian Standards Association (CSA International)
- .1 CSA C22.1-2018, Canadian Electrical Code, Part 1 (24nd Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
- .3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.5 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.
- 1.6 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19.
- .2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- 1.7 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 CONNECTORS AND
TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.
- .2 2, 3, 4 way joint boxes dry location type in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

PART - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- 1.2 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 SUPPORT CHANNELS .1 316 Stainless Steel U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.
- .2 316 Stainless Steel L shape, size 75mm x 75mm, 10mm thick, length field determined.
- .3 Anchor bolts shall be 20mm resin bonded epoxy anchors.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole malleable ironstraps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 2 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 26 05 00 - Common Work Results - For Electrical.
 - .2 Section 26 24 19 - Power Distribution Panel and Miscellaneous Electrical Work
- 1.2 REFERENCES
- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-2018, Canadian Electrical Code, Part 1, 24th Edition.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 SPLITTERS
- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
 - .2 Terminations: main and branch lugs and connection blocks to match required size and number of incoming and outgoing conductors as indicated.
 - .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.
- 2.2 TERMINAL BOXES, JUNCTION BOXES AND PULL BOXES
- .1 Construction: welded steel enclosure.
 - .2 Covers Flush Mounted: 25 mm minimum extension all around.
 - .3 Covers Surface Mounted: screw-on turned edge covers.
 - .4 All boxes in exterior locations to be stainless steel 316 NEMA 4X rated.
-

- .5 Provide backplates, DIN rail, terminal blocks and connectors on all wiring in the terminal boxes.
- 2.3 CABINETS
- .1 Construction: welded sheet steel as indicated, with hinged door, handle, latch and catch.
 - .2 Type E Empty: surface return flange mounting as indicated.
 - .3 Type T Terminal: surface return flange mounting as indicated containing sheet steel back plane.

PART 3 - EXECUTION

- 3.1 SPLITTER
INSTALLATION
- .1 Mount plumb, true and square to building lines.
 - .2 Extend splitters full length of equipment arrangement except where indicated otherwise.
- 3.2 TERMINAL BOXES,
JUNCTION BOXES, PULL
BOXES AND CABINETS
INSTALLATION
- .1 Install pull boxes in inconspicuous but accessible locations.
 - .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
 - .3 Install terminal block as indicated in terminal boxes and Type T cabinets.
 - .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- 3.3 IDENTIFICATION
- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
 - .2 Identification Labels: size 2 indicating system name, power sources, voltage and phase or as indicated.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Submit samples for all boxes and fittings in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

- 2.1 OUTLET AND CONDUIT BOXES GENERAL .1 Size boxes in accordance with CSA C22.1.
.2 102 mm square or larger outlet boxes as required.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 347 V outlet boxes for 347 V switching devices.
.6 Combination boxes with barriers where outlets for more than one system are grouped.
- 2.2 GALVANIZED STEEL OUTLET BOXES .1 One-piece electro-galvanized construction.
.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

- 2.3 MASONRY BOXES .1 Electro-galvanized steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- 2.4 CONCRETE BOXES .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- 2.5 FLOOR BOXES .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.
- 2.6 CONDUIT BOXES .1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.
- 2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.
- 2.8 FITTINGS - GENERAL .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- 2.8 SERVICE FITTINGS .1 'High tension' receptacle fitting made of 2 piece stainless steel with brushed aluminum finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.
- .2 Pedestal type 'low tension' fitting made of 2 piece stainless steel with brushed aluminum finish to accommodate two amphenol jack connectors.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris

- during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
 - .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
 - .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
 - .6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- 1.2 REFERENCES .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
- .5 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).
- .6 CAN/CSA C22.2 No. 83.1-07 (R2017) Electrical Metallic Tubing - Steel
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data: submit manufacturer's printed product literature, specifications and datasheets.
- .1 Submit cable manufacturing data.
- .4 Quality assurance submittals:
- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.
- 1.4 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

- 2.1 CABLES AND REELS .1 Provide cables on reels or coils.
- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length,

voltage rating, conductor size, and
manufacturer's lot number and reel number.

- .2 Each coil or reel of cable to contain only one continuous cable without splices.
 - .3 Identify cables for exclusively dc applications.
 - .4 Reel and mark shielded cables rated 600 volts and above.
- 2.2 CONDUITS
- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
 - .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
 - .3 Rigid schedule 80 PVC conduit: to CSA C22.2 No. 211.2.
 - .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
 - .5 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.
 - .6 Electrical Metal Tubing conduit: to CAN/CSA-22.2 No. 83.1.
- 2.3 CONDUIT FASTENINGS
- .1 One hole malleable iron straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
 - .2 Beam clamps to secure conduits to exposed steel work.
 - .3 Channel type supports for two or more conduits at 2 m on centre.
 - .4 Threaded rods, 6 mm diameter, to support suspended channels.
- 2.4 CONDUIT FITTINGS
- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
 - .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- 2.5 EXPANSION FITTINGS FOR RIGID CONDUIT
- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
 - .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
 - .3 Weatherproof expansion fittings for linear expansion at entry to panel.
-

2.6 FISH CORD .1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Surface mount conduits except underground.

.4 Use rigid hot dipped galvanized steel (RGS) threaded conduit except where specified otherwise.

.5 Use rigid schedule 80 PVC conduit underground or embedded in concrete.

.6 Use flexible metal conduit for connection to equipment in dry areas.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Use electrical metal tubing (EMT) conduit in the electrical room.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

.10 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

.15 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS .1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on suspended or surface mounted channels.
 - .5 Do not pass conduits through structural members except as indicated.
 - .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- 3.4 CONCEALED CONDUITS
- .1 Run parallel or perpendicular to building lines.
 - .2 Do not install horizontal runs in masonry walls.
 - .3 Do not install conduits in terrazzo or concrete toppings.
- 3.5 CONDUITS IN CAST-IN-PLACE CONCRETE
- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
 - .2 Protect conduits from damage where they stub out of concrete.
 - .3 Install sleeves where conduits pass through slab or wall.
 - .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
 - .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
 - .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
 - .7 Organize conduits in slab to minimize crossovers.
- 3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE
- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.
- 3.7 CONDUITS UNDERGROUND
- .1 Slope conduits to provide drainage.
 - .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.
- 3.8 CLEANING
- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
 - .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and installation for standard and custom breaker type panelboards.
- 1.2 RELATED SECTIONS .1 Section 26 05 00 - Common Work Results - Electrical.
- 1.3 REFERENCES .1 Canadian Standards Association (CSA)
.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.
- 1.4 SUBMITTALS .1 Drawings to include electrical detail of the equipment to be installed in the Motor Control Center showing the panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 - PRODUCTS

- 2.1 PANELBOARDS .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
.1 Install circuit breakers in panelboards before shipment.
.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 and 600 V panelboards: bus and breakers rated for 10,000 and 18,000 A (symmetrical) minimum interrupting capacity respectively or as indicated on electrical drawings.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Tin plated aluminum bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges, or as designed for a Motor Control Center section.
- .9 Trim and door finish: baked grey enamel.
- 2.2 CUSTOM BUILT .1 125 mm relay section on one or both sides of
PANELBOARD ASSEMBLIES panels as indicated for installation of low voltage remote control switching components.
- .2 Double stack panels as indicated.
- .3 Contactors in mains as indicated.

- .4 Feed through lugs as indicated.
- 2.3 BREAKERS
- .1 Breakers: Each circuit breaker shall be a quick-make, quick-break, thermal-trip, ground fault current interrupting, branch circuit breakers. Each circuit breaker shall have the short circuit interrupting capacity of 25,000 amperes. Each breaker shall trip free of the operating handle, and the handle shall indicate the position of the breaker. Circuit breakers shall meet the requirements of UL Standard 489.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- .5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.
- 2.4 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Locate panelboard in the Motor Control Center as a section or bucket.
- .2 Connect loads to circuits.
- .3 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Material and installation requirements for the
- .1 Utility Service Coordination and Utility Meter
 - .2 Main Fused Disconnect
 - .3 Manual Transfer Switch
 - .4 Portable Generator Receptacle
 - .5 Surge Suppression Device
 - .6 Motor Control Center
 - .7 Lighting Transformer
 - .8 Motor Disconnect Switches
 - .9 Relay Panel
 - .10 Proximity sensors and limit switches
 - .11 Final acceptance testing requirements.
- 1.2 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- 1.3 REFERENCES .1 Canadian Standards Association (CSA).
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide copies of all correspondence and approvals from the Utility.
 - .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all electrical components and include product characteristics, performance criteria, physical size, finish and limitations.
 - .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Drawings to include:
 - .1 Schematic and wiring diagrams: diagram shall include all power and , control connections. Both electrical devices and each wire between devices shall be identified by an individual designation of letters, numbers, or a combination of both; and such designations shall be used wherever the devices or wires appear on other drawings.
 - .2 A complete interconnection diagram(s) for all electrical apparatus and equipment used in the operation of the movable bridge. The diagram(s) shall be of the point-to-point type and shall show the external connections of all devices and equipment.
-

- .3 Dimensioned installation layout drawings.
 - .4 Any other drawings, which may in the opinion of the Departmental Representative, be necessary to show the electrical work.
- 1.5 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for power distribution panel, manual transfer switch, generator receptacle, and PLC system modifications for incorporation into manual. Information to include the following:
 - .1 Movable Bridge Operation: Include an introduction with a general description of the system, and step by step instruction for opening and closing the span using the normal (utility power), auxiliary (generator power) and emergency (manual) operating modes. Operating instructions shall note all precautions required for correct and safe operation for all operating modes.
 - .2 Movable Bridge Maintenance: Include a description of all maintenance work to be performed including frequency. The maintenance tasks shall be clearly defined including tools, equipment, and parts required.
 - .3 Component Information: Include catalog cuts, installation guides, and manufacturer information for all electrical and mechanical components including name of supplier, make and model number, and technical contact information.
 - .4 As-Built Drawings: Include a legible copy of all record as-built drawings.
- 1.6 EXTRA STOCK MATERIALS
- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Installed spare parts are shown on the Relay Panel plan sheets.
 - .3 Include the following spare parts in addition to the spare parts installed in the panel:
 - .1 Six (6) fuses of each size and type used.
 - .2 Two (2) complete sets of stationary and moving contacts for each size of each contactor used.
 - .3 Two (2) coils for each size contactor used.
 - .4 One (1) indicating light unit for each type and colour used.
 - .5 Eight (8) quad light units to match the type provided on the control console
-

- .6 Two (2) indicating light coloured caps for each type and colour used.
- .7 One (1) circuit breaker for each size and type used.
- .8 One (1) complete overload relay for each size and type used.
- .9 Two (2) pushbutton contact blocks for each size and type used.
- .10 Two (2) selector switch contact blocks for each size and type used.
- .11 Two (2) control relays of each size and type used.
- .12 Two (2) proximity sensors for each type used.

1.7 DELIVERY, STORAGE
AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect all equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 UTILITY SERVICE
COORDINATION AND
UTILITY METER

- .1 The existing electric service is 600-volts nominal, three phase, three wire, 60-Hertz and will be replaced by a 125A, three phase, three wire, 60-Hertz system. All existing feeders will be replaced and routed to a new meter cabinet.
- .2 The Contractor shall be fully responsible for coordinating and contracting the Utility to upgrade the existing service. The contractor shall provide a meter base and Current Transformer (CT) cabinet. The cabinet shall be as specified and approved by the Utility. The Contractor shall coordinate all requirements, inspections, approvals with the Utility directly. The Contractor shall be responsible for all costs to secure the new service, wiring, raceway, and metering from the Utility.
- .3 Utility Work: All work shall be done in accordance with the utility requirements and specifications.

- .4 Scheduling: The Contractor shall schedule all utility work with the sequence of construction.
- 2.2 MAIN FUSED DISCONNECT
- .1 The new service disconnect shall be a fused disconnect switch, the service disconnect shall have quick-make, quick-break contacts. Fuse size and trip rating shall be as indicated on the plans. The fuses shall meet all local code, utility, and CSA requirements for a service disconnect. The fuses shall be rated for 64 KAIC short circuit interrupting capability. The service disconnect shall be listed for use as a service disconnect. The service disconnect shall be installed in a NEMA-4X, stainless steel enclosure equipped. The interior mechanism, back pan and springs shall be stainless steel. The disconnect enclosure handle shall be lockable in both the 'on' and the 'off' position. The disconnect shall be located where shown on the plans. An approved nameplate shall be installed on the enclosure indicating the devices function.
- .2 The disconnect lugs shall be copper, UL Listed for copper cables, and front removable.
- .3 The disconnect switch operating handle shall be an integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent opening the of the switch door while in the 'on' position or placing the switch in the 'on' position while the door is open. The door interlock shall include a bypass method and the switch shall be pad lockable in the 'off' position.
- .4 Fuses:
- .1 ANSI/UL Class RK5 fuses with time delay for all applications not specified or indicated otherwise.
- .2 Current limiting fuses.
- .3 Coordinate fuse size and type with Utility.
- 2.3 MANUAL TRANSFER SWITCH
- .1 A new non-automatic, manual transfer switch shall be installed on the outside wall of the electric room to allow connection of a portable standby generator set in the event of a utility failure.
- .1 General: Rated for total system transfer, continuous load, and tested for use on AC systems. UL listed (Bulletin No. 1008), complying with specified or indicated requirements for enclosed continuous current rating, voltage rating, and number of poles.
- .2 Ratings: 600 volts, 3 phase, 200A continuous rating
- .3 Main Switch Assembly:
- .1 Type: Air-break, double throw, load rate interrupter, mechanically held,

- electrically operated type with live load break manual operator.
- .2 Main and arcing contacts: "Utility" and "Generator" main contacts protected by separate arcing contacts and magnetic blowouts for each pole, or equivalent approved arc quenching provisions.
 - .3 Interlocks: Main contacts electrically and mechanically interlocked so that operating mechanisms cannot close contacts simultaneously in both "Utility" and "Generator" positions.
 - .4 Mechanical Lock: When transfer is completed, contacts mechanically lock in position by operating linkage with release possible only by normal action of the electrical and mechanical operator.
 - .5 Over-current Protective Devices Prohibited: Transfer switches incorporating thermal and/or magnetic over-current devices in addition to switching mechanism will not be acceptable.
 - .6 Contact Replacement: Main and arcing contracts field replaceable without disassembly of the mechanical interlock or disconnection of the power conductors.
- .4 Enclosure: NEMA 4X painted sheet steel, light gray exterior and white interior. Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.
- 2.4 GENERATOR RECEPTACLE
- .1 A new generator receptacle shall be installed on the outside wall of the bridge control house to allow connection of a portable standby generator set in the event of a utility failure.
 - .1 Ratings: 600 volts, 3 phase, 200A continuous rating.
 - .2 Enclosure: NEMA 4X stainless steel or aluminum.
 - .3 Connector Style: Shall match existing portable standby generator set.
 - .4 Receptacle Cover: Provide receptacle cover and chain to cover when removed.
-

- 2.5 SURGE SUPPRESSION DEVICE .1 Provide a surge suppression unit, TVSS style, on the incoming service. The device shall be provided a Stainless Steel 316, NEMA-4X enclosure and mounted as shown on the plans.
- 2.6 MOTOR CONTROL CENTER .1 Furnish and install one Motor Control Center (MCC) that shall be constructed to meet or exceed the requirements within NEMA ICS2-322, CSA, and UL845 for motor control centers. The MCC shall be designed, manufactured, and tested in facilities registered to ISO 9001 quality standards. The MCC enclosure shall be NEMA/EEMAC Type 12. Gasketing shall be closed cell neoprene material. Open cell gasketing shall not be acceptable. The MCC shall be rated for a 600-Volt, 3-Phase, 4-Wire, 60-Hertz system. The starter/contactors coils shall be rated 120 VAC. All mounting hardware and all wire and cable terminals shall be vibration proof. The MCC shall be supplied with the equipment and auxiliaries as shown on the plans and required to control bridge equipment.
- .2 Each vertical section shall be a rigid, freestanding structure, approximately 90 inches high and 15 inches deep. Vertical sections shall have internal base mounting angles at the bottom and external lifting angles at the top running continuous within each shipping block. Lifting eyelets at the top are not acceptable.
- .3 To minimize the chance of fault propagation to adjacent sections, each vertical section shall have side sheets extending the full height and depth of the section. Incoming line lug compartment shall be bottom entry. The size and quantity of incoming cables shall be shown on the drawings.
- .4 Horizontal wireways of standard sections, both top and bottom, shall be not less than 5 inches high. To prevent damage to cable insulation, the wireway opening between sections shall have rounded corners and the edges shall be rolled back.
- .5 A full height vertical wireway and hinged door shall be provided in each standard vertical section, and shall be isolated from the horizontal and vertical bus. Vertical wireways shall be an integral part of each section and shall be independent of plug-in units.
- .6 The power bus system shall be copper, supported, braced, and isolated by a bus support molded of a high strength, non-tracking glass polyester material. Minimum bus bracing shall be 42 kA RMS symmetrical.
-

- .7 The horizontal bus shall be continuously braced within each section. Minimum bus bracing shall be 42 kA RMS symmetrical. It shall be copper with silver plating and rated at 200A. Splicing horizontal buses shall be accomplished using a splice kit of at least the same ampere rating as the horizontal bus bar. These horizontal bus splices shall have at least two (2) bolts, and each bolted connection, and shall be independently capable of handling the load.
 - .8 The vertical bus shall be continuously braced and sandwiched in a glass-filled polyester molding. Minimum bus bracing shall be 42 kA RMS symmetrical. The bus shall be isolated from the other phases. The vertical bus shall be copper with the same plating as the horizontal bus, and shall accommodate plug-in loads totaling up to 200A.
 - .9 The horizontal ground bus bar shall be tin-plated copper and located in the top horizontal wireway. The size of the horizontal ground bus shall be .25 inches x 1 inch, with an effective 200 A continuous rating. A mechanical screw-type ground lug shall be mounted on the ground bus in the incoming line section.
 - .10 The vertical ground bus bar shall be tin-plated copper and supplied in each standard section. The vertical ground bus bar shall be connected to the horizontal ground bus bar and shall form a continuous internal grounding system.
 - .11 A grounding stab shall be provided on each plug-in unit, such that the stab engages onto a tin-plated copper vertical ground bus before the power stabs are engaged, and shall be maintained as the unit is withdrawn until after power stabs are disengaged.
 - .12 A grounding point shall be provided at each starter unit for purposes of landing the ground wire coming from the motor. A vertical tin-plated copper unit load ground bus shall be provided and connected to the horizontal ground bus bar. The vertical load ground bus with the unit load ground connector shall provide a termination point for the load ground cable at the unit.
 - .13 Shutters shall automatically open when a unit is inserted and automatically close when a unit is removed, so that personnel are not exposed to live vertical bus bars and so that the bus is isolated from arcing faults.
 - .14 All units shall be plug-in types. Plug-in units shall consist of a unit assembly, unit support
-

- pan and unit door assembly. After insertion, each plug-in unit shall be held in place by a latch that is located at the front of the unit. Multi-turn latches requiring more than ten (10) turns per latch shall not be acceptable.
- .15 Plug-in power stab assemblies shall be tin-plated copper and designed to tighten during heavy current surges. The stabs shall be backed by stainless steel spring clips to provide a high-pressure connection to the vertical bus. Wiring from the unit disconnecting means to the plug-in stabs shall be routed into this molding such that the wiring is not be exposed at the rear of the unit. Stab assemblies shall be sized to match the rating of the units. Automatic shutters shall be made available for isolation of unused stab openings.
- .16 The unit door shall be fastened to the stationary structure (not the unit itself), so that the door can be closed when the unit has been removed. The door shall be hinged on the left-hand side so that it opens away from the vertical wireway.
- .17 The operator handle of all units shall be interlocked with the MCC frame, so that a unit insert can not be withdrawn or inserted when the operator is in the ON position.
- .18 Each motor controller shall be equipped with a black reset pushbutton to reset the motor overload. Each motor controller shall also be equipped with a red indicator light that shall energize when the motor overloads.
- .19 Terminal blocks shall be mounted within the unit and located near the front for accessibility. They shall not be located at the rear of the vertical wireway. Power terminal blocks shall be provided. Control terminal blocks shall be pull-apart style. Control pull apart terminal shall be rated 25A, 600V, with a maximum wire size of No. 12 AWG. Provide sufficient terminals in each MCC bucket for the control wiring interconnections as shown on the wiring diagrams, with a minimum of 10 terminals in each bucket. All terminal blocks shall with stand vibration and all pull apart terminal blocks shall be held together with captive screws. All terminal block shall be marked to identify the terminations.
- .20 Wiring within the MCC shall be stranded copper with Type SIS insulation, 90 degrees C rated minimum. Control conductor wiring shall be No. 14 AWG minimum. All wires and terminal blocks within the MCC shall be tagged by the vendor in accordance with the approved working drawings.
-

- Manufacturer's standard wiring designations shall not be acceptable in lieu of custom tagging.
- .21 The MCC shall be designed as an arc containing low voltage MCC to help reduce arc flash hazards in accordance with the requirements of the IEEE. The MCC shall be designed and constructed to reduce arc flash hazard. The arc flash protection shall improve personnel protection against internal arcing faults when the doors and covers are closed and secured and with Type 2 accessibility as defined by ANSI C37.20.7-2007. The designed and installed arc protection shall protect personnel when at the front, side and the rear of the MCC enclosure. Arc resistance baffles shall be furnished to allow required venting as for the specified for the individual MCC components. Arc resistant baffles shall allow air flow to help dissipate the heat and still provide Type 2 accessibility. The MCC arc flash protection shall consist of but not be limited to:
 - .22 Arc-resistant latches on all doors that provides pressure relief and assists in keeping doors latched to the MCC during an arcing fault.
 - .23 Arc resistant baffles to allow for the full specified range of MCC equipment for the NEMA 12 enclosure.
 - .24 Copper vertical ground bus on all plug-in structures and heavy duty ground stab on plug-in units shall be furnished that provides an effective path for ground fault currents to minimize fault clearing times of installed overcurrent protective devices.
 - .25 Automatic shutters shall be provided to act as protection against potential electrical shock hazards from unused plug-in stab openings.
 - .26 Insulating covers on horizontal bus closing plates shall be provided to assist in preventing "burn through" which potentially could result from arcing faults in the horizontal bus compartments.
 - .27 The main incoming circuit breaker shall be sized as shown on the plans. The incoming section of the MCC shall house the main circuit breaker, the surge suppression unit, the power monitoring equipment, the phase failure-reversal power failure relay, and the far side MCC shall have the power failure relay monitor mounted on this section.
 - .28 Wiring diagrams shall be provided at a centralized location in the MCC. Each modular

unit shall also be supplied with wiring diagrams and product data. The diagrams shall show the exact devices inside the unit and shall not be a generic diagram. Each diagram shall show the wire numbering and PLC interface information as part of the wiring diagram.

- .29 Control apparatus shall conform to the applicable requirements of NEMA Pub. No. ICS Industrial Controls and Systems, latest revision, and to the following:
- .1 Circuit Breakers: All branch circuits from the buses shall be protected by molded-case circuit breakers mounted on the control panels. All breakers shall have quick-make, quick-break contacts and the mechanism shall be trip-free and trip indicating. Frame sizes shall be not less than 100 amperes. The breakers shall be equipped with thermal-magnetic trips or adjustable instantaneous magnetic trip units. Molded case circuit breakers shall meet the requirements of NEMA Standard AB1, latest revision. Instantaneous magnetic trip circuit breakers, when used, shall only be used for motors and shall be part of a listed combination controller.
 - .2 Motor Starters and Magnetic Contactors: The continuous current rating of contactors and starters shall be adequate for the connected loads, and no starter shall be smaller than NEMA Size 1. Reversing contactors shall be electrically and mechanically interlocked. IEC style contactors shall not be acceptable.
 - .3 Each starter and contactor shall be furnished complete with a thermal overload relay to provide protection. Each overload shall be provided a black pushbutton through the door operator to reset the overload. The pushbutton shall reset the overload without requiring the panel door to be opened.
 - .4 Control Transformers: Control transformers shall be high voltage regulation type, low temperature rise, rated 600/120VAC. The transformer shall be sized as shown on the Contract Plans Each transformer shall have a cover to prevent accidental contact with the energized components. The transformer shall be de-energized when the unit operator handle is in the off position.
 - .5 Push-buttons and Control Switches: push-buttons and control switches on the manual control stations shall be heavy-duty, oil-tight contact blocks operated by glove handle (pistol grip) selector knobs, keys,
-

selector knobs, or push-buttons as indicated in the Plans. Contacts shall be fine silver, capable of interrupting 6 amperes at 120 volts AC and of continuously carrying 10 amperes.

- .6 Indicating Lights: Indicating lights shall be heavy-duty, oil-tight sockets provided with 6-watt lamps rated 120 volts AC. All lenses shall be glass, with color and escutcheon plates as shown in the Plans or called out in this Section.
- .7 Nameplates: Nameplates shall be made of laminated phenolic plastic with white front and back and black core and shall be not less than 3/32 inches thick. All electrical equipment shall be provided with a nameplate. The lettering shall be etched through the front layer to show black engraved letters on a white background. Lettering shall be not less than one-quarter inch high, unless otherwise detailed in the Plans. Nameplates shall be securely fastened to the equipment with stainless steel screws.

2.7 LIGHTING TRANSFORMER

- .1 Furnish and install one transformer in the electrical room. The transformer shall be CSA and UL listed transformer. The transformer core shall be constructed from high grade electrical steel and all windings shall be copper. Coil and core shall be mounted on rubber insulation mounting pads. Sound levels are not to exceed 45db as measured by NEMA ST20. The windings and core and coil assembly shall be treated and built to resist the effects of dirt and moisture. The enclosure is to be rated NEMA-3R with a weathershield.
- .2 KVA rating: 15
- .3 Temperature rise: 65 Degree C rise above a 30 Degree C ambient average.
- .4 Cycles: 60 Hz.
- .5 Phase: 3
- .6 Primary voltage rating: 600 Volts single phase
- .7 Taps: The taps shall be on the primary winding as specified at 2 above and 2 below rated voltage, each rates at 2½%
- .8 Impedance ratings: under 5.0% on rated KVA base with a max. tolerance of 7.5%.
- .9 Secondary voltage rating: 120/240 Volts.

- 2.8 MOTOR DISCONNECT SWITCHES .1 Two (2) motor disconnect switches rated for 25HP motors shall be provided. The switches shall be non-fusible, 3 phase, heavy-duty, safety switches in watertight and dust-tight NEMA-4X, 304 stainless steel enclosures with a lockable handle. The switches shall be rated for the horsepower as shown on the plans. The disconnect switch blades shall open each ungrounded conductor, shall be single throw, and clearly visible when in the 'off' position with the door open. The switch shall be rated for a short circuit current of 10 KAIC.
- .2 The disconnect lugs shall be copper, UL Listed for copper cables, and front removable.
- .3 The disconnect switch operating handle shall be an integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent opening the of the switch door while in the 'on' position or placing the switch in the 'on' position while the door is open. The door interlock shall include a bypass method and the switch shall be pad lockable in the 'off' position.
- 2.9 RELAY PANEL .1 Provide one new relay panel to provide the bridge control for all equipment.
- .1 Circuit Breakers: All breakers shall have quick-make, quick-break contacts and the mechanism shall be trip-free and trip indicating. Frame sizes shall not be less than 100 amperes. The breakers shall be equipped with thermal-magnetic trips or adjustable, instantaneous, magnetic trips units, with trip rating as shown on the Plans or as required.
- .2 Control Relays: Control relays shall be IEC industrial relays with mechanically linked 10 ampere rated contact performance per IEC 60947-5-1. As required they shall be proved with 4-pole auxiliary contact blocks for front mounting. They shall be mechanically linked between N.O. and N.C. poles and to the main relay poles.
- Certifications:
- .1 CCC Certified
- .2 CE Marked
- .3 cULus Listed - File No. E14840; Guide Nos. NKCR/NKCR7
- Standards Compliance:
- .1 CSA C22.2 No. 14
- .2 EN/IEC 60947-1, -5-1
- .3 Meets the material restrictions for European Directive 2002/95/EC - EU-RoHS

- .4 UL 508
 - .3 Specialty relays shall be as follows:
 - .1 Safety Relays: Safety relays shall be heavy duty listed for safety applications. Relays shall meet the requirements of CSA C22.2 No. 14 and UL 508. Cover shall be tamper resistant, colored red to clearly indicate the safety relay, and indicate state. Contacts shall be mechanically interlocked
 - .2 Alternating Relays: The alternating relays shall be solid state with an alternating circuit that drives an internal electromechanical relay. Each time the relay is operated the output contacts will change states. Indicator lights on the case show the internal relay status. Provide a toggle to set either the NORMAL position to alternate, or by setting the toggle switch to Load 1 or Load 2 it will lock the relay in position, preventing alternation.
 - .3 Timing Relays: Time-delay relays shall be of the electro-pneumatic type providing time delay intervals as required with a linear timing range in the ratio of 1:10. Each timing relay shall be provided with a timing head calibrated in linear increments. The number and type of poles shall be as shown in the Plans.
 - .4 Terminal Blocks: Terminal blocks for conductors of Size No. 8 AWG and smaller shall be feed through terminal blocks with stud and nut type connection DIN rail mounted modular terminal blocks. Barriers shall be not less than 13mm high and 3mm thick and shall be spaced 16mm center-to-center. Straps, studs and nuts shall be of a material for use in highly corrosive atmospheres and shall be rated for 57 amperes for a terminated conductor. The blocks shall provide a withstand voltage rating of 800 volts per IEEE switchgear standards. The terminal blocks shall provide studs and nuts suitable for use with flanged fork wire connectors. Corrosion resistant marking strips shall be provided for conductor identification. At least ten-percent spare terminals shall be provided. Fused terminal blocks shall be provided fuses with ratings as shown on the plans.
 - .5 Terminal Connectors: Terminal connectors shall be seamless, heavy duty compression
-

- locking fork terminals manufactured from pure electrolytic copper tubing. Terminals shall be tin plated and provided with a double-thick tongue and insulation grip. Terminals and compression tools must be approved by the Engineer.
- .6 Wire Ferrules Connectors: For conductors not suitable for locking fork terminals, they shall be provided with seamless, heavy-duty insulated wire ferrules terminal lugs. Terminal lugs shall be installed per lug manufacturer recommendations using the proper tools approved by the manufacturer.
- .7 Power Distribution Blocks: Power distribution blocks for all conductors larger than No. 8 AWG, shall be fingersafe, fabricated from copper and approved equal to Ferraz Shawmut FSPDB series, sized as required. Finger-safe fully insulated block shall ensure that no one can touch live parts. They shall be provided with recessed termination screws and wire openings providing IP20 grade protection and qualify as "finger-safe" per IEC 529, integral DIN rail adaptors allowing for quick and easy installations on 35mm DIN rail, and captive termination screws. Provide end anchors for rigid end stops.
- .8 Enclosure: NEMA 12 painted sheet steel, light gray exterior and white interior. Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .9 Power Supply: All 24V DC power supplies shall be rated for 120VAC input at 60 hertz, and 4A, 24V DC output. The power supplies shall be single output, regulated linear DC power supply. The power supply shall be convection cooled, constant voltage, short circuit proof, current limiting (automatic reset) unit with an output voltage adjustment of +/- 5%, and input/output isolation of 1,000 mega-ohms DC. The power unit shall operate over a temperature range of 0° Celsius through 55° Celsius. Units shall be DIN rail mountable, finger safe for mounting in the panel.
- .10 Heater: Thermostatically controlled strip heaters shall be provided in each cabinet to prevent build up of excess moisture. The strip heater shall be rated for 120 VAC.
- .11 Receptacle: All receptacles shall be 20-ampere, 125-volt, three-wire, grounding type, polarized, ground fault current interrupting (GFCI) duplex convenience outlets. Each indoor receptacle shall be

flush mounted in existing a new stainless steel outlet box and shall be provided with a Type 304 stainless steel cover plate. Outdoor receptacles shall be similar except each receptacle shall be provided with waterproof cover plate and shall be mounted in a waterproof, cast-iron, hot-dipped galvanized, surface mounted box. Receptacles shall be specification grade.

- .12 Light: The panel interior shall be suitably lighted and controlled by a switches mounted near and operated by the front doors.
- .13 Push-buttons and Control Switches: push-buttons and control switches on the manual control stations shall be heavy-duty, oil-tight contact blocks operated by glove handle (pistol grip) selector knobs, keys, selector knobs, or push-buttons as indicated in the Plans. Contacts shall be fine silver, capable of interrupting 6 amperes at 120 volts AC and of continuously carrying 10 amperes.
- .14 Potentiometer: The potentiometer shall be equipped with a surface dial to select the resistance on the printed scale. The selection shall allow a maximum setting of 4.7 kilo-ohms.
- .15 Din Rail: DIN rail shall be zinc galvanized steel and sized for the equipment.

2.10 PROXIMITY SENSORS
AND LIMIT SWITCHES

- .1 The Contractor shall furnish all proximity sensors and limit switches indicated on the Contract Drawings, including mounting hardware and all required accessories.
- .2 A total of six (6) inductive type proximity switches shall be furnished and installed, two for the span centering system (for driven and pulled indication) and four (4) for end lifts (for driven and pulled indication). Proximity sensors shall have the following ratings:
 - .1 20-250 vac, 10-300 vdc, 40-60 Hz, hysteresis of 3-15% (5% typical)
 - .2 6 v drop at full rated current across conducting sensor
 - .3 Normally open 2-wire ac self contained output function
 - .4 Short circuit protection
 - .5 Inrush current maximum of 4.0 A
 - .6 Operating temperature of -25 to 70 Celsius
 - .7 Shock resistance of 30 g and a vibration resistance of 55 Hz
 - .8 2 color led indication (green= power on, flashing green= short circuit, red= output energized)

- .9 Rated NEMA 4 and 6
 - .10 20mm sensing range
 - .11 Switching frequency of 150 Hz
 - .12 Electrically shielded, potted PVC connector cable 2 meters in length as an integral part of the proximity switch.
 - .13 Ensure the proximity switch housing is chrome plated brass (cpb), face is nylon 12 with 30% glass filler (pa 12-gf30), end cap is elastomer polyamide thermal plastic (eptr).
 - .3 Industrial Lever Limit Switches: A total of four (4) industrial lever limit switches shall be provided for span position (fully closed, near closed, near open and fully open). The industrial lever limit switches shall have dual form Z contacts, shall be rated NEMA 6P, and shall be provided with epoxy potted cordsets. They shall be provided with suitable lever arms as shown on the Plans.
- 2.11 GROUNDING
- .1 Equipment grounding for the electrical system shall be provided by a continuous equipment grounding conductor within each conduit or multi-conductor cable (except as noted on the plans) and supplemented by the conduit system. The grounding conductors shall be suitably terminated in every metallic box and equipment enclosure on a separate ground bus or terminal with a solid electrical connection to the box or enclosure. No connections are required to non-metallic boxes or enclosures. Conduit entrances requiring grounding bushings shall have all such bushings bonded together and connected to the ground bus or terminal.
 - .2 In accordance with CSA Canadian Highway Bridge Design Code Section 13.9.15.4(b) provide one bridge grounding connection at each end of the swing span, connected to the end lift device bearing plate on each rest pier. Provide two bridge grounding connections to the pivot pier at diametrically opposed positions. Each ground connection shall be sized #1/0AWG.
 - .3 All bonding and grounding conductors shall be adequately sized, but shall not be less than No. 12 AWG copper.
 - .4 Bonding and grounding conductor connectors shall be solderless type, and shall be secured by means of hexagonal head, copper plated steel or bronze machine bolts with lock washers.
-

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install all equipment in accordance with manufacturers recommendations and the approved shop and working drawings.
 - .2 All equipment shall be tested for correct operational functionality and repeatability.
- 3.2 CONSTRUCTION METHODS
- .1 The electrical installation work shall be performed as indicated on the Contract Drawings and in accordance with approved shop drawings and manufacturer's recommendations.
 - .2 All associated construction and installation work such as the installation of the specified operator control panels shall be installed using good installation judgment and in accordance with all prevailing national and local codes and ordinances.
- 3.3 OPERATOR TRAINING
- .1 After the electrical and mechanical work has been completed, tested and approved by the Departmental Representative the Contractor shall conduct on-site operator training. The Contractor's trainer shall be competent to operate both the electrical and mechanical systems and shall be completely familiar with all equipment used for normal and emergency operation. Training shall cover normal (utility power), auxiliary (portable generator power) and emergency (manual) operation and use of bypasses. The 'Installation, Operation, and Maintenance Manuals' shall be completed and approved prior to scheduling training and shall be on hand for reference during the training. The Contractor shall provide a suitable portable generator for testing and training to demonstrate operation of the auxiliary operating mode.
- 3.4 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Ensure moving and working parts are lubricated where required.
 - .3 Control System Factory Inspection and Testing: The enclosed relay panel, motor control center, control console, limit switches, proximity switches, HPU equipment, motors, and other apparatus supplied, assembled or fabricated by the vendor of the electrical control system shall be subjected to shop inspections to demonstrate compliance with all specified requirements. The inspection is intended as a means of facilitating the work and avoiding errors, and it is expressly
-

understood that it will not relieve the Contractor of responsibility for imperfect material or workmanship.

- .1 The enclosed control panels, motor drive cabinets and control desk shall be completely assembled at the factory, and shall be subjected to the manufacturer's standard inspections and testing. The manufacturer's standard testing for the enclosed control panels and control desk shall comprise of at least the following:
- .2 Inspection of materials, fit of parts, finishes and adjustments
- .3 Wire continuity tests, either visual or verified with continuity tester
- .4 Operational check of devices to determine proper pick-up and drop-out voltages and contact operation
- .5 Operational check of circuits to determine proper interlocking of circuits and operator's devices
- .6 Polarity of connections to instruments and other polarity-sensitive devices
- .7 Dielectric test in accordance with applicable NEMA standards
- .8 The enclosed equipment supplied shall be completely interconnected and shall be subjected to electrical and operational testing to ensure accuracy of connections and to demonstrate proper functioning of equipment. Limit switch contacts shall be simulated using the actual limit switches. The actual drive motors, drive systems, motor brakes, machinery brakes, gates, and center lock motor shall be utilized for the factory tests.
- .9 The factory testing shall also include a complete sequenced, simulated operation of the bridge auxiliaries and span.
- .10 The factory inspection and special testing required herein shall be witnessed by the Engineer or his authorized representative, and no equipment shall be shipped from the factory until it has been released for shipment by the Engineer. The Contractor shall provide thirty (30) days notification in advance of the date of tests so that arrangements can be made for the Engineer to be present at the tests. The Contractor shall submit to the Engineer for review, ten (10) working days prior to the testing date, a copy of all standard and all special tests to be performed.
- .11 During the witnessed inspections, nameplate legends, conductor identifications,

instrument scales, escutcheon plate engraving and all other details of construction shall be checked for conformity with specified requirements.

- .4 Demonstration of Complete Electrical System: The Contractor shall schedule checkouts at completion of work and in preparation for final inspection. Notification of the Departmental Representative, and PWGSC should be made two weeks in advance. Should maintenance of electrical power be required during construction or testing of the electrical system, the Contractor shall provide means for temporary power and all power/test equipment will be provided by the Contractor. Set up of temporary power and system testing is the sole responsibility of the Contractor.
- .5 The Contractor shall be responsible for coordinating the testing with the portable generator. All testing shall be performed under both normal and generator power to demonstrate full operating of the bridge under both power systems.
- .6 During testing of power distribution system, the Contractor shall energize all loads simultaneously on a feeder-to-feeder basis for a 24 hour period. Correction of phase imbalances should be made for both power and lighting loads. Should defective equipment or workmanship be evident, correction should be immediate. All equipment, existing or new, should be shown to be operable to the satisfaction of the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA - Canadian Standards Association.
.2 CAN/CSA-Q9000-92 Quality Management Quality Assurance Standards for selection and use.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- 1.3 WASTE, MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19.
.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility as approved by the Departmental Representative.
.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 GENERAL DESCRIPTION .1 One operator control station comprised of selector switches, pushbuttons and indicating lights housed inside a NEMA 4X stainless steel enclosure shall be furnished and installed outside the control house for operation of the bridge.
- 2.2 BRIDGE OPERATOR CONTROL STATION .1 The bridge operator control station shall be rated for outdoor installation NEMA 4X and be of stainless steel construction.
.2 The control station shall be provided complete with a gasketed lockable stainless steel cover.
.3 The enclosure shall be in accordance with the requirements of the Contract Drawings.
.4 All control switches, pushbuttons, and other control devices shall be mounted within the control station. All devices shall be compatible with the requirements of the control system and shall be NEMA 4 suitable for oiltight/watertight.
.5 Selector Switches and Pushbuttons: Pushbuttons and control switches shall be heavy-duty, oil-tight, contact blocks operated by glove handle selector knobs, key switches and push-button operators as indicated on the Plans. Contacts

- shall be fine silver, capable of interrupting 6 amperes at 120 volts AC, and of continuously carrying 10 amperes.
- .6 Indicating Lights: Indicating shall be heavy-duty, oil-tight pilot lights with one, two or four fields as required as per the plans. They shall be provided with LED lamps the color of the lamp lens and shall be rated at 120 VAC. All lenses shall be glass, with color and marking as shown on the Plans. Lights shall be AB 800T quad series lights or approved equal.
 - .7 The escutcheon plates of all control switches, pushbuttons and indicating lights shall be made of aluminum with a satin finish and shall be engraved with an identifying legend as indicated on the Contract Drawings.
 - .8 The wiring within the bridge operator control station shall be flame-retardant, ethylene-propylene insulated, switchboard wire, Type SIS. The wiring shall be arranged systematically so that all circuits can be readily traced. All conductors shall be terminated on easily accessible terminal blocks mounted inside at the rear. Terminal blocks shall be approved by the Departmental Representative. Spare terminals totaling at least 20 percent of those actually used shall be provided. Wiring shall be identified at equipment terminals by marking the adjacent area with bright yellow painted numbers or other means approved by Departmental Representative to correspond to conductor designations appearing on the Contractor's wiring diagram.
 - .9 The Contractor shall submit outline drawings of his proposed operator control station together with catalog cuts of all devices and equipment mounted in the proposed panel. The panel vendor shall provide calculations of his proposed control station heater and blower sizing approved by Departmental Representative prior to fabrication of the control station.
 - .10 The control station shall be mounted atop a stainless steel pedestal as noted on the Contract Drawings.
 - .11 Heater: Thermostatically controlled strip heaters shall be provided in each cabinet to prevent build up of excess moisture. The strip heater shall be rated for 120 VAC.
 - .12 Receptacle: All receptacles shall be 20-ampere, 125-volt, three-wire, grounding type, polarized, ground fault current interrupting (GFCI) duplex convenience outlets. Each indoor receptacle shall
-

be flush mounted in existing a new stainless steel outlet box and shall be provided with a Type 304 stainless steel cover plate. Outdoor receptacles shall be similar except each receptacle shall be provided with waterproof cover plate and shall be mounted in a waterproof, cast-iron, hot-dipped galvanized, surface mounted box. Receptacles shall be specification grade.

- .13 Din Rail: DIN rail shall be zinc galvanized steel and sized for the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the operator control panels in accordance with manufacturers recommendations and the approved shop and working drawings.
- .2 The operator control panel shall be tested for correct operational functionality and repeatability.

3.2 CONSTRUCTION METHODS

- .1 The electrical installation work shall be performed as indicated on the Contract Drawings and in accordance with approved shop drawings and manufacturer's recommendations.
- .2 All associated construction and installation work such as the installation of the specified operator control panels shall be installed using good installation judgment and in accordance with all prevailing national and local codes and ordinances.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with section 26 05 00.
- .2 Ensure moving and working parts are lubricated where required.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - For Electrical.
- 1.2 REFERENCES .1 CSA International
.1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.
.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).
.3 The Munsell System of Colour Notation
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.4 CLOSEOUT SUBMITTALS .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
.2 Operation and Maintenance Data: submit operation and maintenance data for electrical cabinets and enclosures for incorporation into manual.
- 1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.3 Storage and Handling Requirements:
.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to Munsell Notation 7.5GY3.5/1.5, size as indicated.
- .2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m² area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Equip enclosure with hot dipped galvanized mounting rails 1.3 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
 - .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
 - .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Cover: tamperproof, bolt-on, domed to shed water.
- .6 Door: 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .8 Enclosure construction such as to allow configuration of single or ganged enclosures.
- .9 Enclosure capable of being shipped in knocked-down condition.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.
- .2 Mount equipment in enclosure.
- .3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA - Canadian Standards Association.
- .2 CAN/CSA-Q9000-92 Quality Management Quality Assurance Standards for selection and use.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- 1.3 WASTE, MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by the Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 GENERAL DESCRIPTION .1 The bridge shall be furnished with two (2) navigation lights used as indication and warning lights for marine traffic.
- .2 Each navigation lights shall consist of one green and one red lights as indicated on the Contract Drawings.
- 2.2 NAVIGATION LIGHTS .1 The navigation lights shall be pedestal type lights. Each light shall be a single unit, 205 mm outside diameter lens, with two 90 degree red and two 90 degree green Fresnel lens. The light shall be mounted on a short section of 60mm stainless steel pipe with bronze mounting flange. Light housing shall be of cast silicon bronze suitable for marine environment. Construction shall be rain-tight and fully gasketed. The light assembly shall be designed for heavy duty, long life service. The fixture shall be designed as a swing span light.
- .2 All navigation light fittings shall be non-corroding, and the sockets shall be of porcelain mounted on shock absorbers. Each navigation light shall be furnished with a single medium base, 8-

watt,120-volt, 100,000 hour LED lamp, with color matched to the lens.

- .3 The Contractor shall submit outline-dimensioned drawings, of his proposed navigation lighting unit, mounting details, and specification in the form of catalog cuts of proposed lights to be approved by the Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the navigation lights in accordance with manufacturers recommendations and the approved shop and working drawings.
- .2 Each navigation light shall be tested for correct operational functionality and repeatability.
- .3 Supports shall be as shown on the plans.

3.2 CONSTRUCTION METHODS

- .1 The electrical installation work shall be performed as indicated on the Contract Drawings and in accordance with approved shop drawings and manufacturer's recommendations.
- .2 All associated construction and installation work such as the installation of the specified limit switches shall be performed using good installation judgment and in accordance with all prevailing national and local codes and ordinances..

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with section 26 05 00.
- .2 Ensure moving and working parts are lubricated where required.

END OF SECTION

Part 1 - General

- 1.1 REFERENCES .1 CSA - Canadian Standards Association.
- .2 CAN/CSA-Q9000-92 Quality Management Quality Assurance Standards for selection and use.
- .3 TAC - Manual of Uniform Traffic Control Devices.
- .4 OTC - Ontario Traffic Manual
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- 1.3 WASTE, MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by the Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 GENERAL DESCRIPTION .1 A total of Two (2) electrically operated traffic gates shall be furnished.
- .2 One (1) electrical operated pedestrian gate shall be furnished.
- .3 The gates shall be controlled from the operators control station.
- 2.2 TRAFFIC GATES .1 A total of two (2) motor-operated, traffic gates of the railway grade-crossing type shall be furnished and installed at the approach roadways to the bridge, as indicated on the Contract Drawings. The west gate shall also have a sidewalk arm, the east gate shall be a single arm.
- .2 Each gate shall have an arm of the length for the road width of 7620 mm (Contractor to verify in the field), which shall open through an angle of 90 degrees from the horizontal to the vertical. The west gate shall have a pedestrian arm of the length for the sidewalk width of 900mm (Contractor to verify in the field), which shall

- open through an angle of 90 degrees from the horizontal to the vertical. Each gate shall have a welded steel stand arranged to provide a weather tight housing for the motor, disconnect switch, gear train, limit switch and fuses for warning lights. The gate stands shall be hot-dip galvanized after fabrication. The transmission gearing for each gate shall be enclosed. Weathertight, gasketed doors shall be provided for access to the operating equipment. A hand crank shall be provided for manual operation of each gate together with hand crank release limit switch..
- .3 Each gate shall be customized to ensure only the breakaway portion of the gate arm extends into the roadway.
 - .4 The gate arms shall be made of single rail, 102mm square, 6005-T5 aluminum extruded tubing. Each gate arm shall be adequately braced transverse to its motion to resist wind loads and to reduce whipping and shall be guyed to prevent sagging. Each assembled gate arm shall be designed for a 120 KPH wind load. A bumper rod with compression spring shall be provided near the end of each gate arm to stop the travel at the closed position without undue shock.
 - .5 All bolts, screws or other fastenings used in the gate arm assembly and for connection to the gate stand shall be of stainless steel.
 - .6 The warning lights shall be furnished on the gate arms. Each warning light shall be a weatherproof, two-way, cast aluminum unit with red fresnel lenses front and back. The lights shall be interconnected with three conductor cables using galvanized rigid steel conduit and watertight connectors at the fixtures. A red long life LED lamp shall be installed in each fixture. The lights and equipment shall be arranged and connected so that adjacent units will flash alternately. Fuses for the warning lights shall be 10-ampere midget cartridge fuses installed in molded rubber connection kits.
 - .7 Each traffic gate shall be provided with a warning gong. Each gong shall be a weatherproof, motor-operated, 12-inch gong mounted on either the traffic gate housing and provided with a custom base for fastening to the gate housing; or on a separate mounting pole. The gong shall be of cast bronze, fire alarm bell metal and shall be held with theft-proof nuts.
 - .8 An 8-circuit limit switch shall be provided in each gate, operated by the gate mechanism. Each limit switch shall be rotary-cam type and it shall be gear driven from the transmission. The
-

- contacts shall be quick-break with silver alloy buttons. The limit switch shaft shall be stainless steel, and cams shall be secured thereto with setscrews.
- .9 The motor for each traffic gate shall be furnished as part of the gate system. Each motor shall be a totally enclosed, 575-volt, 3-phase, 60-cycle, ball bearing induction motor and shall be capable of withstanding instant reversal when running at full speed. Each motor and gear train shall be capable of opening and closing the gate in about 13 seconds. A motor-mounted, spring set, magnetically-released, 120 Volt, 60 Hz disc brake shall be provided for stopping and holding the mechanism. A watertight disconnect switch shall be provided to permit disconnecting the motor and brake from the incoming power.
 - .10 Each gate housing shall be equipped with a thermostatically controlled heater, switched service light, and duplex, 15-ampere, 120-volt, specification grade GFI receptacle. A 15-ampere circuit breaker shall protect the above units and be mounted in the gate housing.
 - .11 All internal wiring for each gate shall be brought to numbered terminal blocks inside the housing for the connection of existing circuits.
 - .12 Each gate arm shall be striped on both faces with alternate red and white reflectorized stripes in accordance with Ontario Traffic Manual (OTM) requirements, measured parallel to the edge of the gate arm. The stripes shall slope downward at an angle of 45 degrees toward the centerline of the roadway. The galvanized gate stands shall be left unpainted so that the galvanized surfaces can weather. Wiring between the gate arm and housing shall be watertight, flexible and be enclosed with interlocked armor of galvanized steel.
 - .13 Each gate shall be furnished with lockable doors and chain attached bronze padlocks. All locks shall be keyed alike.
 - .14 Gate housing doors shall be provided with neoprene gaskets, stainless steel swing bolts and catches, and safety interlock switches.
 - .15 In erecting the gates, the arms shall be carefully attached to the supporting members so as to make a rigid connection. The arms shall be counterbalanced and the limit switches adjusted so that the arms are stopped in a truly vertical or horizontal position. All traffic gates shall be attached to the bridge deck with stainless steel or galvanized anchor bolts. Bolts and
-

attachments to the deck shall be furnished in accordance with manufacturer's recommendations.

- .16 No exposed electrical or control wiring shall be permitted. All wiring on the gate arm shall be in rigid metal conduit. Wiring between the gate arm and housing shall be of the armoured flexible type.
- .17 The Contractor shall submit outline drawings dimensioned layout, schematic and wiring diagrams of the traffic gates to the Departmental Representative for approval prior to fabrication.

2.3 PEDESTRIAN GATE

- .1 A total of one (1) motor-operated, single-arm, pedestrian gates of the railway grade-crossing type shall be furnished and installed at the approach roadways to the bridge, as indicated on the Contract Drawings.
- .2 Each gate shall have an arm of the length for the sidewalk width of 900mm (Contractor to verify in the field), which shall open through an angle of 90 degrees from the horizontal to the vertical. Each gate shall have a welded steel stand arranged to provide a weather tight housing for the motor, disconnect switch, gear train, limit switch and fuses for warning lights. The gate stands shall be hot-dip galvanized after fabrication. The transmission gearing for each gate shall be enclosed. Weathertight, gasketed doors shall be provided for access to the operating equipment. A hand crank shall be provided for manual operation of each gate together with hand crank release limit switch.
- .3 The gate arms shall be made of single rail, 102mm square, 6005-T5 aluminum extruded tubing. Each gate arm shall be adequately braced transverse to its motion to resist wind loads and to reduce whipping and shall be guyed to prevent sagging. Each assembled gate arm shall be designed for a 120 KPH wind load. A bumper rod with compression spring shall be provided near the end of each gate arm to stop the travel at the closed position without undue shock.
- .4 All bolts, screws or other fastenings used in the gate arm assembly and for connection to the gate stand shall be of stainless steel.
- .5 The warning lights shall be furnished on the gate arms. Each warning light shall be a weatherproof, two-way, cast aluminum unit with red fresnel lenses front and back. The lights shall be interconnected with three conductor cables using galvanized rigid steel conduit and watertight connectors at the fixtures. A red long life LED lamp shall be installed in each fixture. The lights and equipment shall be arranged and

- connected so that adjacent units will flash alternately. Fuses for the warning lights shall be 10-ampere midget cartridge fuses installed in molded rubber connection kits.
- .6 Each pedestrian gate shall be provided with a warning gong. Each gong shall be a weatherproof, motor-operated, 12-inch gong mounted on the pedestrian gate housing and provided with a suitable base for fastening to the gate housing. The gong shall be of cast bronze, fire alarm bell metal and shall be held with theft-proof nuts.
 - .7 An 8-circuit limit switch shall be provided in each gate, operated by the gate mechanism. Each limit switch shall be rotary-cam type and it shall be gear driven from the transmission. The contacts shall be quick-break with silver alloy buttons. The limit switch shaft shall be stainless steel, and cams shall be secured thereto with setscrews.
 - .8 The motor for each pedestrian gate shall be furnished as part of the gate system. Each motor shall be a totally enclosed, 575-volt, 3-phase, 60-cycle, ball bearing induction motor and shall be capable of withstanding instant reversal when running at full speed. Each motor and gear train shall be capable of opening and closing the gate in about 13 seconds. A motor-mounted, spring set, magnetically-released, 120 Volt, 60 Hz disc brake shall be provided for stopping and holding the mechanism. A watertight disconnect switch shall be provided to permit disconnecting the motor and brake from the incoming power.
 - .9 Each gate housing shall be equipped with a thermostatically controlled heater, switched service light, and duplex, 15-ampere, 120-volt, specification grade GFI receptacle. A 15-ampere circuit breaker shall protect the above units and be mounted in the gate housing.
 - .10 All internal wiring for each gate shall be brought to numbered terminal blocks inside the housing for the connection of existing circuits.
 - .11 Each gate arm shall be striped on both faces with alternate red and white reflectorized stripes in accordance with Ontario Traffic Manual (OTM) requirements, measured parallel to the edge of the gate arm. The stripes shall slope downward at an angle of 45 degrees toward the centerline of the roadway. The galvanized gate stands shall be left unpainted so that the galvanized surfaces can weather. Wiring between the gate arm and housing shall be watertight, flexible and be enclosed with interlocked armor of galvanized steel.
-

- .12 Each gate shall be furnished with lockable doors and chain attached bronze padlocks. All locks shall be keyed alike.
 - .13 Gate housing doors shall be provided with neoprene gaskets, stainless steel swing bolts and catches, and safety interlock switches.
 - .14 In erecting the gates, the arms shall be carefully attached to the supporting members so as to make a rigid connection. The arms shall be counterbalanced and the limit switches adjusted so that the arms are stopped in a truly vertical or horizontal position. All pedestrian gates shall be attached to the bridge deck with stainless steel or galvanized anchor bolts. Bolts and attachments to the deck shall be furnished in accordance with manufacturer's recommendations.
 - .15 No exposed electrical or control wiring shall be permitted. All wiring on the gate arm shall be in rigid metal conduit. Wiring between the gate arm and housing shall be of the armoured flexible type.
 - .16 The Contractor shall submit outline drawings dimensioned layout, schematic and wiring diagrams of the pedestrain gates to the Departmental Representative for approval prior to fabrication.
- 2.4 GATE CONCRETE BASES
- .1 In accordance with Sections 03 20 00 and 03 30 00.
 - .2 Anchor bolts: refer to structural drawings for details for the anchors, bolts, nuts, and washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the gates in accordance with manufacturers recommendations and the approved shop and working drawings.
- .2 Each gate shall be tested for correct operational functionality and repeatability.
- .3 Excavate for gate concrete bases in accordance with Section 31 23 33.01.

3.2 CONSTRUCTION METHODS

- .1 The electrical installation work shall be performed as indicated on the Contract Drawings and in accordance with approved shop drawings and manufacturer's recommendations.
 - .2 All associated construction and installation work such as the installation of the specified limit switches shall be performed using good installation judgment and in accordance with all prevailing national and local codes and ordinances.
-

3.3 FIELD QUALITY
CONTROL

- .1 Perform tests in accordance with section 26 05 00.
- .2 Ensure moving and working parts are lubricated where required.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
- .1 Under this Mechanical Work section, the Contractor shall furnish, install, adjust, paint, test, and place in operation new swing span machinery, comprising of the pivot bearing assembly, span drive cylinder assemblies, live load bearing assemblies, balance wheels and track assembly, end castor assemblies, end lift assemblies, span lock assembly and end stop assembly as detailed on the Contract Drawings and as specified in these Specifications. The Contractor shall also remove and dispose of existing mechanical components in accordance with the requirements herein.
 - .2 The Contractor shall be responsible for the coordination of the mechanical work with all other work items as necessary to produce completed systems which meet the requirements of the Contract Documents. This shall include the installation of hydraulic cylinders and limit switches to be mounted with the mechanical machinery but supplied under separate sections.
 - .3 This work includes furnishing all labor, materials, tools, services and equipment required to perform the removal, supply, installation, adjustment, lubrication and testing of the mechanical machinery shown on the Contract Drawings and as indicated herein.
- 1.2 LIMITS OF WORK
- .1 The limits of work included for this section are primarily as indicated on drawings M1 to M11, M13 and M14 of the Contract Drawings and as specified herein.
- 1.3 STANDARDS
- .1 All new machinery items must meet the requirements of the National Standard of Canada CAN/CSA-S6-14 Canadian Highway Bridge Design Code, hereinafter referred to as CHBDC.
 - .2 Standards referred to in the Contract Documents are published by the following organizations and are directly applicable to the material and workmanship required by this item.
 - .1 ASTM - American Society for Testing and Materials
 - .2 ANSI - American National Standards Institute
 - .3 CSA - Canadian Standards Association
 - .4 AWS - American Welding Society
 - .5 SSPC - The Society for Protective Coatings
- 1.4 SUBSTITUTIONS
- .1 Items specified by manufacturer name or part number on the Contract Drawings may be replaced by an equivalent item by another manufacturer, subject to approval by the Departmental
-

Representative, with the understanding that all changes required by the substitution are made at no additional cost. Item equivalency shall be determined at the sole discretion of the Departmental Representative and may be based on one or more of the following: quality, function, ease of maintenance, physical size, reliability, value, load capacity (static and dynamic), durability, availability and other criteria as deemed appropriate by the Departmental Representative.

- 1.5 AVAILABILITY .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- 1.6 ADMINISTRATIVE .1 Submit to the Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples.
- .4 Where items or information is not produced in SI Units, converted values are acceptable.
- .5 Review submittals prior to submission to the Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents by the Contractor. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and that affected adjacent Work is coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by the Departmental Representative's review and/or approval of submittals.
-

- .9 Contractor's responsibility for deviations from requirements of Contract Documents is not relieved by the Departmental Representative's review.
- .10 Keep one reviewed copy of each submission on site.
- 1.7 DIMENSIONS/
CERTIFIED DRAWINGS
- .1 Dimensions indicated on the Contract Drawings are nominal and intended for information. Many of the dimensions indicated on the Contract Drawings have been obtained from existing drawings or from information provided by various machinery manufacturers. The dimensions have not been field verified or obtained from certified drawings from the various manufacturers. All dimensions indicated on the Contract Drawings must be verified in the field or from certified drawings from the various machinery manufacturers by the Contractor. Notify the Departmental Representative of any dimensional deviations found during the verification. Make all required field measurements and obtain certified dimensions for all manufactured products necessary before proceeding with shop drawings, fabrication, and installation. The Contractor is solely responsible for converting dimensions from Metric to Imperial Units, or vice versa, as required.
- 1.8 SUBMITTALS
- .1 Shop drawings, erection drawings, machinery installation procedures, final record drawings, and other required submittals specified herein, shall be submitted in accordance with the requirements of the Contract.
- .2 Submit complete drawing packages for all mechanical machinery systems as follows:
- .1 Pivot Bearing Assembly
 - .2 Span Drive Cylinder Assemblies
 - .3 Live Load Bearing Assemblies
 - .4 Balance Wheels and Track Assembly
 - .5 End Castor Assemblies
 - .6 End Lift Assemblies
 - .7 Span Lock Assembly, including Receiver Plate and Mount
 - .8 End Stop Assembly
- Any submittals that do not contain all documents required for the manufacture, assembly and erection of the machinery systems will be returned without review.
- 1.9 SHOP DRAWINGS
AND PRODUCT DATA
- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
-

- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
 - .3 Provide a detailed shop drawing submittal schedule to the Departmental Representative within thirty (30) days of the "Notice to Proceed".
 - .4 Draw all shop drawings to scale and provide the scale on the drawings. Ensure that details of a given part are clearly visible at the scale selected for that part with the exception that enlarged views of small details within a part may be used to improve clarity and prevent excessively large drawings.
 - .5 Indicate materials, methods of construction and attachment or anchorage, connections, schedules for fabrication, shop assembly procedures, diagrams showing sequence and details for erection, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications as well as drawings provided under other sections.
 - .6 Identify conflicts between manufacturers' instructions and Contract Documents and submit resolution for review and approval.
 - .7 Identify variations between Contract Documents and product or system limitations that may be detrimental to the successful performance of the completed work.
 - .8 Submit copies of producer or manufacturer data. This includes specifications, tests and installation instructions for the following items, but not excluding other items or materials not specifically mentioned.
 - .1 Mill reports and physical tests of all metals
 - .2 Bolts, nuts, washers and other fasteners
 - .3 Paint
 - .4 Lubricants
 - .5 Standard stocked items
 - .9 Allow fifteen (15) working days for the Departmental Representative's review of each submission.
 - .10 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of
-

- Work, state such in writing to the Departmental Representative prior to proceeding with Work.
- .11 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
 - .12 Accompany submissions with transmittal letter containing:
 - .1 Date
 - .2 Project title and number
 - .3 Contractor's name and address
 - .4 Identification and quantity of each shop drawing, product data and sample
 - .5 A sequential number (i.e. number resubmittals with the original submittal number and an alphabetic suffix)
 - .6 Other pertinent data
 - .13 Submissions include:
 - .1 Date and revision dates
 - .2 Project title and number
 - .3 Name and address of:
 - .1 Subcontractor
 - .2 Supplier
 - .3 Manufacturer
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents
 - .5 A complete shop bill of materials for all machinery parts
 - .6 Details of appropriate portions of Work as applicable:
 - .1 Fabrication
 - .2 Layout, showing dimensions, including identified field dimensions and clearances
 - .3 Setting or erection details
 - .4 Capacities
 - .5 Performance characteristics
 - .6 Standards
 - .7 Operating weight
 - .8 Wiring diagrams
 - .9 Single line and schematic diagrams
 - .10 Relationship to adjacent work
 - .11 Instructions for painting the machinery
 - .12 All appropriate weld symbols along with stress relieving process for weldments
 - .13 The surface finish of machined surfaces and tolerances for each dimension for which a specific fit is required. Fit and finish per CHBDC Sections 13.7.5 and 13.7.6 and Contract Documents
-

- .14 Dimension and provide tolerances for all parts to ensure that components of a common purpose that are fabricated from the same detail are interchangeable
 - .15 Tolerances for all drawing dimensions, either directly or via a standard title block, as necessary to obtain proper fit and function of assembled components
 - .16 The required tension, method of tightening and all other pertinent information for all machinery connection bolts
 - .7 Proprietary parts shown in outline on the drawings with sufficient dimensions and data to determine the clearances required for installation and operation.
 - .8 Certified dimension prints from equipment manufacturers stating pertinent ratings of the equipment, weight, and indicating, when applicable, provisions for adding, draining, and checking the lubricant, method of lubrication, amount and type of lubricant required. The type of fittings, the location of inspection openings and the location and type of venting devices.
 - .9 Complete assembly and erection drawings shall be furnished. These drawings shall be given identifying marks and essential dimensions for locating each part or assembled unit with respect to the bridge or equipment foundation. Every part shall be cross referenced to the sheet on which it is detailed. Contract Drawings shall not be submitted as a substitute for assembly or erection drawings.
 - .10 Indicate on the shop drawings, for review by the Departmental Representative, the type of tightening, type of wrench and the value of torque or other pertinent information of all connection bolts for all items and machinery.
 - .14 After the Departmental Representative's review, distribute copies.
 - .15 Submit electronic copies of product data sheets or brochures for requirements requested in the specifications where shop drawings will not be prepared due to standardized manufacture of product.
 - .16 Submit electronic copies of test reports for requirements requested in the specifications and as requested by the Departmental Representative.
 - .17 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be
-

provided has been tested in accord with specified requirements.

- .1 Testing must have been within three (3) years of date of contract award for project.
- .18 Submit electronic copies of certificates for requirements requested in the specifications and as requested by the Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .19 Submit electronic copies of manufacturer's instructions for requirements requested in specification sections and as requested by the Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .20 Submit electronic copies of manufacturer's field reports for requirements requested in specification sections and as requested by the Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .21 Submit electronic copies of operation and maintenance data for requirements requested in specification sections and as requested by the Departmental Representative.
- .22 Delete information not applicable to project.
- .23 Supplement standard information to provide details applicable to project.
- .24 If upon review by the Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, approved electronic documents will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.10 INSTALLATION
PROCEDURE

- .1 Prepare a detailed written installation procedure for the installation of all mechanical machinery. Include sequence of installation, alignment

- methods, bolt tightening methods and required tension values for all bolts. Include resumes for all supervising engineers and millwrights associated with machinery installation and alignment with the written installation procedure.
- .2 Demonstrate to the Departmental Representative that the Contractor has full knowledge of machinery connections and alignment procedures and that the work will be performed by qualified millwrights.
 - .3 Begin installation of the machinery after the procedures and resumes have been submitted by the Contractor and they are satisfactory in the sole opinion of the Departmental Representative. Correct and resubmit the procedure and/or submit resumes for alternate personnel as necessary to the satisfaction of the Departmental Representative. This resubmission procedure, if required, is not cause for delay.
 - .4 Ship mechanical machinery items to the job site after the Contractor has submitted a satisfactory installation procedure.
- 1.11 FINAL AS-BUILT DRAWINGS
- .1 Submit drawings of all materials as fabricated following fabrication. Clearly indicate any deviations from the approved shop drawings. Stamp these drawings "As Built", immediately above the title block.
- 1.12 MAINTENANCE AND LUBRICATION MANUAL
- .1 Contents of Manual:
 - .1 Table of contents, in the following order.
 - .2 Manufacturer's literature describing each piece of equipment and giving manufacturer's model number and drawing number.
 - .3 Schematics that show all components of the machinery that require lubrication. Include also on the charts, the type and frequency of lubrication.
 - .4 Copies of all warranties on equipment supplied to the project. For each item of work defined in this specification, provided with a warranty.
 - .5 Copies of all approved installation procedures.
 - .6 Copies of all assembly, erection and shop drawings. These drawings to include "as built" information in the final version of the manual.
 - .7 Steps for cursory inspection that should be carried out annually.
 - .8 Steps for semi-in-depth inspection that should be carried out every three (3) years.
 - .9 Steps for in-depth inspection that should be carried out every six (6) years.
-

- .10 List of nearest local suppliers of all equipment parts.
 - .11 List of parts and supplies that are to be furnished as part of the Contract.
 - .12 Name, address, and telephone number of the local manufacturer's representative and of the service company for each piece of equipment so that pieces or spare parts can easily be obtained.
- .2 Submit six (6) preliminary copies of the manual prior to shipment of machinery to the site. Complete the preliminary manual in all respects with regard to material content, organization and legibility for review by the Departmental Representative. Preliminary copies need not comply with presentation requirements including size, paper weight, paper reinforcement and protection including oil, moisture and wear resistant covers, and copy method.
- .3 Preliminary copies will be reviewed, and the changes made will be incorporated into the final manual. Submit six (6) final copies of the manual after the machinery is in operation. Incorporate into the final manual the Departmental Representative's comments on the preliminary manual and all field changes made during construction and installation. Ensure permanence of the manuals by complying with all presentation requirements.
- .4 Provide an electronic copy of the final manual in portable document format (PDF). PDF file shall include a live table of contents which matches the paper versions which shall direct the user to the desired section by clicking on it. Scanned copies of documents shall only be included where no clean electronic version exists that was directly converted from parent program.
- .5 Furnish manufacturer's operating and maintenance manuals giving complete instructions relative to assembly, installation, operation, adjustment, lubrication, maintenance, and carrying complete parts lists for every item of equipment furnished by Contractor.
- .6 Manuals may be manufacturer's standard publications if they comply with specified requirements relative to quantity and quality of information and data.
- .7 Neatly imprint the covers and title page with a descriptive title and that contain the name of the bridge, owner, and location. Include on the title page the names of the Departmental Representative, the Contractor, and the date of issue. Separate the various sections which comprise the manual with divider pages. All parts
-

- information must be correct for the equipment provided under this Contract. Modify standard parts drawings to be suitable and block out irrelevant material. Modify all general information used as necessary to show pertinence to the equipment furnished under this Contract and remove irrelevant material. Specific part numbers shall be clearly provided for all parts and shall be clearly indicated on the documents where more than one part is tabulated, to separate from all similar parts given in the table series. There shall be no ambiguity as to which specific part configuration is used in the installation. Submit the arrangement of the manual, method of binding, including material and text to the Department Representative for approval.
- .8 Illustrations must be clear. Printed matter, including dimensions and lettering on drawings, must be easily legible. If reduced drawings are incorporated into the manuals, darken the original lines and letters if necessary, to retain their legibility after reduction. Larger drawings may fold into manuals to page size. Reproduce diagrams and prints used in the manual to a size less than 279 mm by 432 mm. Include diagrams on white paper and vacuum seal in transparent plastic material impervious to moisture and oil, and resistant to abrasion. Other formats which are equal in clarity, sharpness, durability and permanence will be considered.
- .9 Prepare the manuals from the following materials:
- .1 Tear, water, and grease resistant paper
 - .2 Page size, 216 mm by 279 mm
 - .3 Fold out diagrams and illustrations
 - .4 Reproducible by dry copy xerography method
 - .5 Oil, moisture and wear resistant hard or flexible plastic covers
- .10 Provide the Departmental Representative with a lubrication plan for approval. Develop with the plan from recommendations made by the machinery manufacturers and in accordance with the requirements of Section 2.4, Lubrication.
- .11 Furnish a minimum of one (1) lubrication chart which shows all points requiring lubrication with type of lubricant to be used at each point and the frequency and the method of lubrication. Produce the lubrication chart on a 559 mm by 864 mm sheet. Submit the chart to the Departmental Representative for approval and mount the approved chart in a watertight frame. Mount the lubrication chart in the Parks Building near the hydraulic power unit or as directed by the Department Representative.
-

PART 2 - PRODUCTS

2.1 GENERAL MATERIAL
AND WORKMANSHIP

- .1 All materials shall be new and conform to ASTM standards and other standards listed in these Specifications and on the Contract Drawings, unless noted otherwise.
- .2 Supply materials from manufacturers who have manufactured similar materials for similar applications for a period of not less than ten (10) years.
- .3 Brinell or Rockwell hardness tests shall be made and results included on inspection reports for all materials for which hardness values are required on the Contract Drawings, in the material specifications, or specified herein.
- .4 Do not fabricate, machine, weld, cast or forge items without sufficient advance notification to the Departmental Representative to permit scheduling of required inspection. All facilities where work is being done shall provide for free access at the plant or shop for the inspection of materials and workmanship, and to witness shop tests. The inspector has the authority to recommend to the Departmental Representative rejection of material or workmanship that does not meet the requirements of the Contract Documents. The Departmental Representative shall make the final decision for rejection.
- .5 Furnish the Departmental Representative with the number of unpriced copies of purchase orders as may be required for scheduling tests as outlined in these Specifications.
- .6 Unless otherwise provided, furnish without charge, test specimens required herein, and all labor, testing machines, tools and equipment necessary to prepare the specimens and to make the physical tests and chemical analyses. Submit copies of test reports and various tests to the Departmental Representative.
- .7 Fabrication of metal components shall be in accordance with the requirements of Section 05 12 33 and as modified herein.

2.2 FASTENERS

- .1 All bolts, either for connecting machinery parts to each other or to supporting members are categorized as one of the following types:
 - .1 finished high-strength bolts;
 - .2 turned bolts, turned cap screws, and turned studs; and
 - .3 high-strength turned bolts, turned cap screws and turned studs.

- .2 Provide finished high-strength bolts for all high-strength bolts shown on the Contract Drawings unless otherwise shown.
 - .3 Meet the requirements of ASTM A449 for finished high-strength bolts. Provide high-strength bolts with finished bodies and regular hexagonal heads. Individually ream holes for high-strength bolts for a clearance of not more than 0.25 mm (0.10 in) larger than the actual diameter of individual bolts for that hole.
 - .4 Provide turned bolts, turned cap screws, and turned studs with turned shanks, cut threads, and finished washer-faced hexagonal heads. The finished shank of all turned bolts, turned cap screws, and turned studs, shall be 1.6 mm (1/16 in) larger in diameter than the diameter of the thread. Determine the head and nut dimensions based on the thread diameter. For the shanks of all turned fasteners, use a Class LT1 fit in the finished holes in accordance with ASME B4.1. Provide material for the turned shank fasteners that meets the requirements of ASTM F568M, Class 4.6 (ASTM A307, Grade A).
 - .5 Provide high-strength turned bolts, turned cap screws, and turned studs meeting the requirements above, except provide material meeting the requirements of ASTM A449.
 - .6 Elements connected by bolts shall be drilled and reamed assembled to ensure accurate alignment of the hole and accurate fit over the entire length of the bolt within the specified limit.
 - .7 Dimensions of all bolt heads, nuts, and hexagonal head cap screws are to conform to ASME B18.2.
 - .8 Provide heavy series heads and nuts for turned bolts, turned cap screws, and turned studs.
 - .9 Tighten ASTM A449 bolts to 90% of their required proof load (length measurement method). Provide the method of tightening and of verifying the tension in all bolts on the shop drawings for approval by the Departmental Representative.
 - .10 Dimensions of socket-head cap screws, socket flat-head cap screws, and socket-set screws are to conform to ASME B18.3. Unless otherwise call for on the Contract Drawings or specified herein, make the screws from heat-treated alloy steel, cadmium-plated, and furnish with a self-locking nylon pellet embedded in the threaded section. Set screws are to be of the headless, safety type with threads of the coarse thread series and having cup points. Do not use set screws to transmit torque nor as the fastening or stop for
-

- any equipment that contributes to the stability or operation of the bridge.
- .11 Fabricate all threads for bolts, nuts, and cap screws to conform to the coarse thread series having a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance ASME B1.1.
 - .12 Spot face all bolt holes through unfinished surfaces for the head and nut, square with the axis of the hole.
 - .13 Unless otherwise called for, subdrill all bolt holes in the machinery parts for connecting these parts to the supporting steel work at least 0.8 mm (1/32 in) smaller in diameter than the bolt diameter and ream for the proper fit at assembly or at erection with the steel work after the parts are correctly assembled and aligned.
 - .14 Furnish positive locks of an approved type for all nuts, except those on ASTM A449 finished high-strength bolts. Use double nuts for all connections requiring occasional openings or adjustment. Provide tempered steel and conform to the SAE regular dimensions for lock washers, where applicable. Use materials that meet the SAE tests for temper and toughness.
 - .15 Furnish hardened plain washers at each end of high-strength bolts meeting the requirements of ASTM F436M.
 - .16 Provide cotters conforming to the SAE standard dimensions and made of half-round stainless steel wire meeting the requirements of ASTM A276, Type 316.
 - .17 Provide anchor bolts connecting machinery parts to existing concrete meeting the requirements of ASTM F1554, Grade 105 material and hot-dipped galvanized per ASTM A153/A153M unless indicated otherwise on the Contract Drawings. When anchor bolts connect a mechanical component directly to the concrete, there must be a filler material in the annular area between the bolt and the hole in the machinery component. The filler material may be non-shrink grout, babbitt metal or zinc.
 - .18 Anchor bolts securing machinery to new concrete shall be headed and cast in place (not drilled). Anchor bolts securing machinery to existing concrete shall be fully threaded, installed with Hilti HY-200 epoxy adhesive and installed in accordance with the manufacturer's recommendation or an approved epoxy-based alternative.
 - .19 Anchor bolts shall have minimum embedment as follows unless indicated deeper on the Contract Drawings:
-

.1 Bolt Dia.	Min. Embedment Lengths (mm)
M20	230
M22	250
M24	300
M30	460

- .20 Use only fasteners manufactured in North America with the property class and source identification appearing on the top of head.

2.3 FORGINGS

- .1 Forgings: reduced to size from a single bloom or ingot until perfect homogeneity is obtained. Blooms and ingots: shall have a cross sectional area equal to at least three times the required size. Forging: shall be done at no less than red heat. Rounds for shafts and bars: shall be true, straight and free from all injurious flaws such as piping, laps, seams or cracks. Forgings shall be subjected to ultrasonic examination in accordance with ASTM A388. Any indications using the straight beam method that cannot be readily explained by the geometry of the piece shall be cause for rejection. Any forgings that are rejected shall be replaced at no cost to the Department.

2.4 LUBRICATION

- .1 The size of grease lubricating fittings shall be standardized and shall be of the giant button head type, unless indicated otherwise on the Contract Drawings or unless the locations of the fitting requires the use of a fitting that is smaller than the giant button head fitting. Under no circumstance shall the use of more than 2 different types of grease fittings be permitted. The minimum rated pressure of the fittings is 68,950 MPa (10,000 psi).
- .2 Provide fittings with a steel check valve that will receive grease and close against backpressure.
- .3 Locate fittings in a protected and conveniently accessible position for use. Connect the fittings to the points requiring lubrication by pipe extensions where necessary. All fittings and pipe material: shall be stainless steel meeting ASTM A312/A312M, Type 316 unless otherwise noted. Indicate piping necessary to provide access for lubrication on the shop drawings and list pipe components in the bill of materials.
- .4 Furnish the Departmental Representative with copies of letters from the machinery manufacturers endorsing the lubricants that have been selected. Select lubricants for year-round exposure at the bridge. All lubricants selected shall be compatible with lubricants currently in use by the Department. Submit written

documentation indicating compatibility for any lubricant which is not in current use by the Department.

- .5 Furnish grease for installation and testing of the machinery. Furnish an additional supply for future maintenance use to include a one (1) year supply of lubricant. For the center bearing lubricant, provide two (2) times the volume used to fill the bearing. Provide the lubricant in the original manufacturer's sealed container to prevent contamination.
- .6 Protect all lubricants used during construction from contamination.

2.5 PAINT

- .1 All machinery components, whether commercial or custom, shall be painted with the same paint system and same finished colour in the shop.
- .2 Paint and touch-up of field damaged paint for all non-machined surfaces shall be in accordance with Section 09 91 13.23.
- .3 Use an epoxy mastic high build, aluminum filled primer for all machined surfaces that require paint but cannot be blast cleaned. Provide surface preparation in accordance with paint manufacturer's requirements. Provide intermediate and topcoat of paint in accordance with paint requirements noted in Section 09 91 13.23.
- .4 Exercise caution to prevent cleaning and painting materials from entering machinery components and coming into contact with sliding surfaces which would be damaged by such intrusion. Exercise extreme care to protect all lubricated and faying surfaces. Do not paint lubricated, sliding and faying surfaces. Seals and shaft interface within 3mm of seal lips shall not be painted. Unpainted shaft surface shall be protected with grease used to lubricate bearings. Nameplates on purchased components shall not be painted.
- .5 The colour of the finish coat of all parts shall be FS-595C 15052 Blue and as specified in the Contract Documents.
- .6 Underside of components which will be grouted in place using epoxy grout as per Section 2.10 herein, shall be prepared according to grout manufacturer's recommendations and shall not be finish painted.
- .7 Include all painting instructions on the shop drawings.

2.6 GALVANIZING

- .1 Galvanize required components per CAN/CSA G164-M92 (R003).

-
- .2 Protect areas where the galvanized coating is removed during the machining process with a galvanized coating per ASTM A780/780M.
- .3 Prepare and paint all galvanized surfaces which are to be painted in accordance with ASTM D6386.
- 2.7 SHAFTING AND PINS
- .1 Provide rolled shafts and pins that meet the requirements of ASTM A675/A675M Grade 515 (75) unless indicated otherwise on the Contract Drawings.
- .2 Finish shafts and pins accurately, round, smooth and straight. Straightness: 0.15 mm per meter for shafts up to and including 38 mm in diameter and 0.25 mm per meter for shafts over 38 mm in diameter.
- .3 Forged shafts and pins: meet the requirements of Forgings. Provide a 60-degree lathe center with clearance hole at the exact center of the shaft for finished ends of forged shafts.
- .4 Prepare the ends of forged shafts with bored holes for a device equivalent to the lathe center.
- .5 For stepped shafts, finish fillets smoothly to adjacent surfaces without tool marks or scratches. The maximum surface finish roughness for fillets is 0.8 micro-meter in accordance with ASME B46.1 unless indicated otherwise on the Contract Drawings.
- 2.8 JOURNAL BEARINGS AND BUSHINGS
- .1 Produce bronze bushings of the materials indicated on the Contract Drawings.
- .2 Provide bronze bushings in journal bearings with grease grooves as indicated on the Contract Drawings. Blend the edges of the grease grooves smoothly into the bearing surface. The entry hole from the grease fitting must intersect and lie completely within the grooves. Machine cut the grease grooves. Hand cutting of grease grooves is not acceptable.
- 2.9 SHIMS
- .1 Produce shims required for levelling and alignment of machinery and equipment from half-hard tempered Brass Alloy 260 conforming to ASTM B19 or ASTM B36. Nominal shim pack shall be 12 mm (1/2 in) thick unless otherwise noted on Contract Drawings.
- .2 Neatly trim the shims to the dimensions of the assembled part base and drill for all bolts that pass through the shims.
- .3 Furnish sufficient shims to provide for a total thickness of not less than two (2) times the
-

dimensions given as "nominal shims", with one (1) shim equal to the nominal thickness.

- .4 Make every effort to use full-size shims and achieve full contact between the shims and mating components to achieve the specified alignment requirements. In some cases, the use of partial or custom-machined tapered shims may be required to achieve the alignment requirements. Partial shims shall only be used when the gaps produced between mating parts by the use of partial shims is less than 0.4 mm (1/64 in).
- .5 At least two (2) bolts must pass through any shim that is used. Shims shall be shown and fully dimensioned as details on the shop drawings. Shims with open side or U-shaped holes for bolts will not be permitted. Bolt holes shall not be punched at machine shop to prevent distortion of the shims.
- .6 In cases where partials shims would produce a gap greater than or equal to 0.4 mm (1/64 in), use a custom-machined tapered shim. Custom machined tapered shims may be machined from structural steel plate provided a single shim is used to fill the gap and the exposed portions are properly painted according to the structural painting specification. The cost of any partial or custom shims (including materials, manufacturing, engineering, shipping, field measurements, etc.) is considered incidental to the work and no additional compensation will be made for providing partial or custom shims.
- .7 Assemble shims not installed after final alignment and tag with the part number from the approved shop drawings, then deliver to a location determined by the Department Representative for future use by the Department.

2.10 NON-SHRINK EPOXY
GROUT PADS FOR
MACHINERY SUPPORTS

- .1 Provide non-shrink epoxy grout for use under machinery supports where noted on the Contract Drawings. Epoxy grouts which are volatile, and which give off noxious fumes are not acceptable.
- .2 Submit manufacturer's product data and installation instructions for approval. Grout type shall be suitable for gap size and surface area between concrete and underside of component and for temperature under which grout shall be applied. Submit certificates of compliance or laboratory test reports indicating that the material meets the following:
 - .1 Minimum Compressive Strength per ASTM C579, Method B:
 - .2 1 day: 75.9 MPa (11,000 psi)
 - .3 28 day: 103 MPa (15, 000 psi)

- .4 Effective bearing area per ASTM C1339: \geq 95%
 - .5 Tensile Strength as per ASTM C307: \geq 14.5 MPa (2,100 psi)
 - .6 Flexural Strength as per C580: \geq 26.2 MPa (3,800 psi)
 - .3 Surface Preparation
 - .1 Existing concrete surfaces to receive grout shall be prepared by chipping, sandblasting, or other methods to remove defective concrete laitance, dirt, oil, grease, and other foreign matter to achieve sound, clean and roughened concrete surfaces. New concrete surfaces may be uniformly roughened before it has set using a nail rake in one direction only. Cover all shims, anchor bolts and leveling screws to prevent the grout from adhering. Cover concrete areas with protective waterproof covering until ready to place grout.
 - .2 Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean as recommended by manufacturer.
 - .3 Align and level components to be grouted and maintain in final position until grout placement is complete and accepted. If shims are used, they shall be circular to avoid stress raisers.
 - .4 Install forms for grout about spaces to be grouted as per manufacturer's recommended procedure. All formwork shall be coated with a bond breaker. The tops of such forms shall be minimum of 12 mm above the underside of the bearing surface. The side forms shall be set 25 mm back from the edge of the base plate to avoid air entrapment. The forms shall have a 45-degree angle chamfer strip at all vertical corners and top edges of grout corners. Minimum chamfer width shall not be less than 15 mm. The spread of grout from the edge of the base plate must be less than 50 mm.
 - .4 Placing Grout
 - .1 Place grout in accordance with the respective manufacturer's instructions and recommendations. Pour grout from one side only until grout rises 6 mm above the plate on opposite side of said plate. Strapping and plunging or other recommended method may be used to force grout to flow under the entire area.
 - .2 Do not remove leveling shims, jack screws, etc. for at least 48 hours after grout has been placed. After shims/screws have been
-

removed, fill voids with grout, packing the material with a suitable tool.

- .3 Cure as recommended by the grout manufacturer. Grout shall be placed in ambient temperatures compatible with the manufacturer's recommendations where practical. Contractor shall provide protection from rain if required. If heating is required, the contractor shall provide a suitable tented volume over the component large enough for workers to perform the work and it shall be heated during entire pre-placement, placement and curing process to maintain temperature of grout and mating concrete within manufacturer's curing temperature requirement.
- .4 Store and use grout in strict accordance with the manufacturer's recommendations.

2.11 WELDING

- .1 Perform welding required for the work and weld inspection in accordance with the requirements of the Structural Welding Code as stated in ANSI/AWS D1.1/D1.1M.
- .2 Treat all machinery and weldments that support machinery as main members and all welds as joining primary components, unless otherwise specified in the Contract Documents.
- .3 Do not perform field welding on any machinery components unless specified in the Contract Documents.
- .4 Stress relieve welded machinery parts or supports by heat prior to final machining according to AWS D1.1/D1.1M.
- .5 Include welding and stress relieving procedures with the shop drawings for parts that require welding and/or stress relief.

2.12 PIVOT BEARING ASSEMBLY

- .1 The pivot bearing assembly (1) shall be replaced with new assembly according to the Contract Drawings.
- .2 The pivot bearing shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.

2.13 SPAN DRIVE CYLINDER ASSEMBLIES

- .1 The span drive hydraulic system shall be replaced with a new system according to the Contract Drawings.

2.14 LIVE LOAD BEARING ASSEMBLIES

- .1 The live load bearing assemblies (2) shall be replaced with new assemblies according to the Contract Drawings.

- .2 Each bearing bushing shall be cast bronze, ASTM B22/B22M UNS No. C86300.
- .3 Each bearing shall utilize a forged alloy steel pin with a lubrication passage drilled axially and radially as shown on the Contract Drawings. Grease lubrication shall be utilized for corrosion protection and the purging of bearing contaminants. Grease fittings shall be located to promote ease of maintenance.
- .4 Each live load bearing shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.
- 2.15 BALANCE WHEELS
AND TRACK ASSEMBLY
- .1 The balance wheel assemblies (6) shall be replaced with new assemblies (8) according to the Contract Drawings.
- .2 Each assembly shall be provided with cylindrical bronze bushings. The bushings shall be cast bronze, ASTM B22/B22M UNS No. C911000.
- .3 Each assembly shall utilize a forged alloy steel pin with a lubrication passage drilled axially and radially as shown on the Contract Drawings. Grease lubrication shall be utilized for corrosion protection and the purging of bearing contaminants. Grease fittings shall be located to promote ease of maintenance.
- .4 Each balance wheel shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.
- .5 The new balance wheel track assembly shall be constructed of three (3) standard 80 lb. ASCE rail sections rolled to the correct radius and adequately secured by means of rail clips as shown on the Contract Drawings to rail support plates which are grouted in place using non-shrink epoxy grout. Rail joints shall be provided with joint bars. Rail ends shall be tight with maximum 1.5 mm (1/16 in) gap.
- .6 The track assembly shall be positioned with a concentricity and elevation tolerance as defined on the Contract Drawings.
- .7 The new track anchors shall be positioned to avoid interference with existing anchor locations. The Contractor shall coordinate the pivot pier rehabilitation work such that installation of the new anchor bolts are embedded into solid concrete, and to the depth required for the minimum value.
-

2.16 END CASTOR
ASSEMBLIES

- .1 The end castor assemblies (2) shall be replaced with new assemblies according to the Contract Drawings.
- .2 Each bearing bushing shall be cast bronze, ASTM B22/B22M UNS No. C86300.
- .3 Each bearing shall utilize a forged steel pin with a lubrication passage drilled axially and radially as shown on the Contract Drawings. Grease lubrication shall be utilized for corrosion protection and the purging of bearing contaminants. Grease fittings shall be located to promote ease of maintenance.
- .4 Each end castor shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.

2.17 END LIFT
ASSEMBLIES

- .1 The end wedge assemblies (2) shall be replaced with new eccentric roller end lift assemblies according to the Contract Drawings.
- .2 Each bearing and roller bushing shall be cast bronze, ASTM B148 UNS No. C95800.
- .3 Each bearing shall utilize split bushings. Each bearing shall also utilize brass liners to allow for future adjustment in increments of 0.075 mm (0.003 in).
- .4 Each roller shall utilize half bushings.
- .5 Provisions for greasing bearing and roller bushings are as shown on the Contract Drawings. Grease lubrication shall be utilized for corrosion protection and the purging of bearing contaminants.
- .6 Each end lift shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.
- .7 Mill duty hydraulic cylinders (2) shall be provided with bore, rod and stroke dimensions as shown on the Contract Drawings. Each cylinder shall be clevis bracket mounted to a base as shown on the Contract Drawings.

2.18 SPAN LOCK
ASSEMBLY

- .1 The center latch system (1) shall be replaced with a new assembly according to the Contract Drawings.
- .2 Each guide bushing shall be cast bronze, ASTM B22/B22M UNS No. C91300.
- .3 The span lock assembly shall utilize a forged alloy steel bar. Grease lubrication shall be applied by brush to the portions of the steel bar

that are retracted from the guides when in the withdrawn position.

- .4 The span lock assembly shall be assembled, checked for fits and painted in the shop. Protect the machined surfaces during cleaning and painting operations.
 - .5 A mill duty hydraulic cylinder shall be provided with bore, rod and stroke dimensions as shown on the Contract Drawings. The cylinder shall be clevis bracket mounted to a base as shown on the Contract Drawings.
- 2.19 END STOP ASSEMBLY .1 The end stop assembly (1) shall be replaced with a new assembly according to the Contract Drawings.
- 2.20 HYDRAULIC OPERATING SYSTEM .1 A hydraulic operating system shall be replaced with a new system according to the Contract Drawings.
- .2 Hydraulic circuitry shall provide power for new span drive cylinders, new end lift cylinders, a new span lock cylinder, and existing west and east guard gate cylinders.
 - .3 Refer to Section 24 05 00 of these specifications for hydraulic operating and control system requirements.
- 2.21 SPARE PARTS .1 General - five (5) lubrication fittings of each different type and size used.
- .2 Pivot Bearing Assembly - one (1) P Seal as shown on the Contract Drawing.
 - .3 Balance Wheels and Track Assembly - twelve (12) galvanized single bolt rail clip to match those provided for 80 lb. ASCE rail.
 - .4 End Lift Assembly - one (1) South Assembly without hydraulic cylinder and one (1) North Assembly without hydraulic cylinder as shown on the Contract Drawings.
 - .5 Refer to Section 24 05 00 of these specification for hydraulic spare parts.

PART 3 - EXECUTION

- 3.1 FIELD MEASURING .1 Prior to fabricating new machinery components, field survey and measure the existing bridge site, as required, ensuring that the replacement components and other system modifications as shown on the Contract Drawings will fit within their designated locations. Perform all such surveys and measurements before preparation of shop drawings. The Contractor is responsible to

ensure the field measurement and shop drawing accuracy is sufficient to eliminate errors in in installation, fit and function.

3.2 CONSTRUCTION
DETAILS

- .1 Supply all apparatus, tools, devices, materials and labour to manufacturer, ship, install, erect, align, adjust, lubricate, test, and paint, to complete machinery work as provided in the Contract Documents. Furnish any apparatus, tools, devices, materials and labour incidental to the work, but not specifically stated or included at no additional cost.

3.3 COMPONENTS TO BE
REMOVED

- .1 In general, all existing mechanical/hydraulic operating system components shall be removed from the bridge.
- .2 All existing components removed from the bridge shall be made available on-site by the Contractor for pick up by the Department. Anticipated components to be removed and made available on-site include, but are not limited to, the following:
 - .1 Existing pivot bearing assembly.
 - .2 Existing drive cylinders and support brackets.
 - .3 Existing live load bearing assemblies.
 - .4 Existing balance wheel assemblies.
 - .5 Existing balance wheel track and anchorage system.
 - .6 Existing end castor assemblies.
 - .7 Existing end wedge assembly, including cylinders.
 - .8 Existing center latch assembly, including cylinder and pier mounted latch pocket.
 - .9 Existing rigid stop.
 - .10 Existing hydraulic lines that run between the existing hydraulic power unit and swing span mechanical component cylinders.
 - .11 Existing hydraulic power unit located in the gate house.
- .3 Components not designated by the Departmental Representative for pick up shall be disposed of by the Contractor in accordance with all federal, provincial and local regulations, including paint, lubricants and other hazardous materials.
- .4 Remove these components in accordance with Section 02 41 13 and Section 02 42 00 of these specifications.

3.4 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new (unless specified otherwise in the Contract Documents), not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence

as to type, source and quality of products provided.

- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at Contractor's expense and be responsible for delays and expenses caused by rejection.
- .3 Should disputes arise as to quality or fitness of products, decision rests strictly with the Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout.

3.5 INSPECTION

- .1 The Departmental Representative reserves the right to inspect all machinery at the factory prior to shipping. Provide the Department Representative with full access to the manufacturer's fabrication facility for such inspections.
- .2 Inspections are based on the requirements of the Specifications and Contract Drawings, referenced codes or standards, and the Contractor's approved submittal documents. The Departmental Representative has the authority to stop fabrication or shipment of any material, component, or assembly that does not comply with specified requirements. Replace or repair to the satisfaction of the Departmental Representative any such rejected item. All such replacements or repairs are made at the Contractor's expense.
- .3 The Department Representatives will make inspections of equipment throughout the construction period. Correct defects, deficiencies, or deviations discovered during such inspections at no additional cost. Shop approval of machinery does not relieve the Contractor from making such repairs as directed by the Departmental Representative.

3.6 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

3.7 STORAGE, HANDLING
AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Coat finished metal surfaces and unpainted metal surfaces that would be damaged by corrosion, as soon as practical after finishing with a corrosion inhibitor. Remove this coating from all surfaces prior to lubrication for operation and from all surfaces prior to painting after erection.
- .3 Mount assembled units on skids or otherwise crate for protection from weather, dirt and all other injurious conditions during shipment and storage as approved by the machinery manufacturer. Submit in advance information as to methods and materials which will be used for protection for approval by the Departmental Representative.
- .4 Store machinery items as to permit easy access for inspection and identification. No outdoor storage of machinery components is permitted regardless of the methods of protection provided.
- .5 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .6 Store products subject to damage from weather in weatherproof enclosures.
- .7 Store cementitious products clear of earth or concrete floors, and away from walls.
- .8 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .9 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .10 Correct damage that occurs to the machinery components as a result of improper protection during shipment or storage by the Contractor to the satisfaction of the Departmental Representative at no additional cost.
- .11 Touch-up damaged factory finished surfaces to the Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

3.8 MANUFACTURERS
INSTRUCTIONS

- .1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions.

- .2 Notify the Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that the Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and reinstallation at no increase in Contract Price or Contract Time.

3.9 INSTALLATION

- .1 Commence demolition of existing components after the navigation closure begins, and after all required components have been manufactured and approved for installation, preparations by others where required have been satisfactorily completed and machinery installation procedure has been approved.
- .2 Provide millwrights and supervising engineers with successful prior experience in the installation of movable bridge machinery. The installation and adjustment of all machinery is to be led by millwrights with successful prior experience in this class of work. It is not acceptable for the installation and alignment of machinery to be led by workers of any trade other than the millwright trade.

3.10 SEQUENCE OF WORK

- .1 As part of the installation procedure, provide a complete sequence of installation for review by the Departmental Representative.
- .2 Prior to setting the final end lift elevations to produce the required dead load reaction and roadway transition it is necessary to complete the balancing work and set the elevations of the end castors. Achieving the required dead load reactions and roadway transitions may require adjustment of the swing span elevation at the pivot bearing assembly. This will require jacking the swing span to add or remove shims between the new pivot bearing and loading girder.
- .3 Prior to final adjustment of the balance wheel clearances, set the final swing span elevation.

3.11 ALIGNMENT

- .1 General
 - .1 All standard manufactured components shall be aligned to the tolerances specified by the manufacturer of that component unless otherwise noted on the Contact Drawings or the Specifications. Submit the manufacturers recommended alignment tolerances for a new installation as part of the installation procedure.

- .2 Defined position of pier mounted machinery components is based on a superstructure temperature of 10°C. At installation, Contractor shall compensate for differences in temperature above or below 10°C.
 - .4 Pivot Bearing
 - .1 The center point of the existing pivot bearing shall be measured and located by the contractor prior to removal. The Contractor shall provide accurate and redundant reference monuments in the pier top to re-establish the pivot bearing location after the center pier rehabilitation is complete.
 - .2 The elevation of the pivot bearing base shall be adjusted prior to the installation of grout material beneath the base. In determining the final elevation of the pivot bearing base, the Contractor shall consider the actual swing span deflection under dead load, the required approach elevations and the required end reactions with the end lifts raised. This is the basis for establishing the elevation of all remaining machinery components.
 - .3 The pivot bearing base shall be secured level, i.e. to within 0.250 mm across its length and width, prior to acceptance of the remaining portions of the assembly. With the pivot bearing installed, the swing span secured to its top weldment and the end castors and end lifts engaged with their rests and load plates, it too shall be level.
 - .5 Span Drive Cylinders
 - .1 The alignment of the span drive cylinders will be considered acceptable when the cylinder is level within 3 mm over the length of the cylinder with the bridge closed and end lifts driven.
 - .2 Contractor to ensure both cylinders travel to end of strokes when span is fully open or fully closed. Adjustment shall be made with shims between cylinder clevis and pier mount weldment as required.
 - .6 Live Load Bearings
 - .1 The alignment of the live load bearing rollers will be considered acceptable when the rollers have a clearance of 3.0 mm ± 0.5 mm with their respective roller rests with the end lifts driven. Adjustments shall be made between the base and center pier or the roller rest and bolster to achieve proper clearance. The live load bearings shall be as close as practical to the elevations given on the drawings.
-

.7 Balance Wheels and Track

- .1 The alignment of the balance wheel rail will be considered acceptable when the top of the rail is flat and level within ± 0.5 mm over the entire rail and the rail is concentric to the center bearing within ± 1.5 mm.
- .2 The alignment of the balance wheels will be considered acceptable when the gap between each balance wheel and the track is as noted below with the span in the closed position, the end castors firmly in contact with their castor rests and the end lifts fully withdrawn:

<u>Balance Wheel Location</u>	<u>Gap</u>
Bolster at Beam B4	14 mm \pm 0.5 mm
Bolster at Girder G1/G2 toward East (Long Arm)	10 mm \pm 0.5 mm
Bolster at Girder G1/G2 toward West (Short Arm)	6 mm \pm 0.5 mm
Bolster at Beam B2	2 mm \pm 0.5 mm

.8 End Castors

- .1 The alignment of the end castors will be considered acceptable when both castors are in firm contact (gap of less than 0.05 mm at either edge) with the castor rests, the pin axis is in line with the pivot point of the swing span (tolerance is ± 2 mm from centerline of pivot) and the elevation of the roadway on the swing span is within 3 mm of the abutment roadway over the width of the roadway joint.

.9 End Lifts

- .1 The alignment of the end lift will be considered acceptable when the dead load reaction at each end lift is measured to be 224 kN \pm 10%, the elevation of the roadway on the swing span is within 3 mm of the abutment roadway over the width of the roadway joint and the eccentric rollers are centered with the load plate within ± 3 mm. The rollers shall be in contact with the load plate across their full width.
- .2 With the end lift fully raised, i.e. the cylinder fully withdrawn, the roller is intended to be 5 degrees past vertical to prevent unintentional lowering.

.10 Span Lock

- .1 The alignment of the span lock will be considered acceptable when the swing span is fully closed, the end lifts are fully raised to accommodate live load and the lock bar is centered within its receiver. Final adjustment can be achieved utilizing the

provided shims, for the clearances specified on the Contract Drawings.

.11 End Stop

- .1 The alignment of the end stop will be considered acceptable when the swing span is fully closed, and no gap exists between the girder and abutment attachment strike plates. This position shall be coincident with the span drive cylinders being at full stroke.
- .2 The end stop assembly, i.e. the abutment mounted attachment and girder mounted attachment, shall be installed centered with one another with the swing span fully closed and the end castors set to their final elevation and fully bearing between wheel and rest.

3.12 SPAN BALANCE

- .1 The bobtail swing span is asymmetrical about the longitudinal roadway centerline, and about the transverse pivot girder, so the natural imbalance due to the sidewalk and long arm of the bridge is accounted for in the structural design. The following procedure is suggested for fine tuning the bridge balance using the counterweights for adjustment to an acceptable condition. The procedure shall be performed after adjusting the clearances between the balance wheels and rail to the required value, specified under Section 3.11.5, Balance Wheels and Track.
- .2 The Contractor shall test the balance of the swing span longitudinally and transversely about the pivot bearing at least two (2) times. The initial span balance shall be performed after the span is set on the pivot bearing. The final span balance work shall be performed at the completion of the Contract work including installation of permanent balance material. A detailed balance procedure shall be developed and sealed by a Professional Engineer licensed in Ontario, Canada. The procedure shall be submitted to the Departmental Representative for review and approval at least six (6) weeks prior to balancing the swing span. The following procedure is offered for the Contractor's consideration. The Contractor is advised that the procedure offered below demonstrates a method of balancing the bridge but is not complete in all respects. The Contractor's procedure shall include a complete description of all equipment and methods to be employed. The Contractor may submit an alternate procedure for review. Alternate procedures will be reviewed and accepted or rejected at the sole discretion of the Departmental Representative.

.3 Longitudinal Balance

- .1 Allow the pivot bearing to be the sole supporter of the swing span with the exception of any balance wheels that may contact the rail, as the span imbalance may be greater than the static friction of the pivot bearing prior to starting the span balance procedure.
- .2 Determine the clearance between the balance wheels and the balance wheel track for each of the balance wheels (four total) closest to the longitudinal centerline of the bridge and located under the floor beams adjacent to the pivot girder.
- .3 Jack the bridge using two hydraulic jacks, equally spaced from the longitudinal centerline of the bridge, placed on the side of the pivot bearing which has the least clearance or in contact at the balance wheels. The jacks should be the same distance from the pivot bearing. Connect the two jacks so that the pressure to each jack is the same. Jacks shall be equipped with load cell indicators.
- .4 Jack the bridge until one of the balance wheels on the opposite side of the pivot bearing from the jacks just contacts the balance wheel track.
- .5 Release the pressure in the jacks and determine if the bridge remains in the jacked position or returns to the position prior to jacking.
- .6 If the bridge returns to the position prior to jacking then the span is out of balance in the longitudinal direction. If the span does not return to its original position proceed to step 10.
- .7 Drive the end lifts, or install blocking to secure bridge for the purpose of adding weight to the bridge.
- .8 Add temporary weight at the end of the bridge opposite from the jacks. Weights may be placed on deck along the end floor beam.
- .9 Repeat steps 1 through 8 until the span does not return to its original position after jacking. For every successive cycle, increase the weight versus the weight used in previous cycle.
- .10 Jack the bridge from the low side (side with balance wheel in contact) with a dial indicator positioned to indicate movement of the pivot bearing top weldment on the opposite side of the pivot bearing from the jacks. Dial indicator to be on longitudinal centerline of the bridge. Determine the force required to initiate movement, after first eliminating any balance wheel contact,

- as it may affect the readings. Record this value as F west or F east accordingly.
- .11 Jack the bridge until just before the balance wheels opposite the jacks contact the balance wheel track.
 - .12 Jack the bridge from the opposite side with a dial indicator positioned to indicate movement of the pivot top weldment on the opposite side of the pivot bearing from the jacks. Dial indicator to be on longitudinal centerline of the bridge. Determine the force required to initiate movement of the pivot top casting. Record this value as F west or F east accordingly.
 - .13 Once the measurements are made, assign the larger as F_{L1} and the smaller as F_{L2} .
 - .14 Determine the longitudinal imbalance force using the following equation:
$$F_{\text{ImbL}} = (F_{L1} - F_{L2}) / 2$$
 - .15 Determine the required weight change at the longitudinal end of the bridge using the following equation:
$$W_L = F_{\text{ImbL}} (d/D)$$

Where,
 F_{ImbL} = Longitudinal Imbalance force at distance d (from step 13 and 14).
d = Distance to jacks along longitudinal axis of bridge
D = Distance to added weight along longitudinal axis of bridge
 W_L = Weight change added to the F_{L2} side of bridge or removed from the F_{L1} side of the bridge.
Note: All weight changes shall be made so as to keep the total weight used to a minimum.
- .4 Transverse Balance
- .1 Allow the pivot bearing to be sole supporter of the swing span with the exception of any balance wheels that may contact the rail, as the span imbalance may be greater than the static friction of the pivot bearing prior to starting the span balance procedure.
 - .2 Determine the clearance between the balance wheels and the balance wheel track for each of the balance wheels (four total) closest to the transverse centerline of the bridge.
 - .3 Jack the bridge using two hydraulic jacks, equally spaced from the transverse centerline of the bridge, placed on the side of the pivot bearing which has the least clearance or in contact at the balance wheels. The jacks should be the same distance from the bearing. Connect the two jacks so that the pressure to each jack is the same. Jacks shall be equipped with load cell indicators.
-

- .4 Jack the bridge until one of the balance wheels on the opposite side of the pivot bearing from the jacks just contacts the balance wheel track.
- .5 Release the pressure in the jacks and determine if the bridge remains in the jacked position or returns to the position prior to jacking.
- .6 If the bridge returns to the position prior to jacking then the span is out of balance in the transverse direction. If the span does not return to its original position proceed to step 10.
- .7 Drive the end lifts, or install blocking to secure bridge for the purpose of adding weight to the bridge.
- .8 Add temporary weight at the side of the bridge opposite from the jacks. Weights may be placed on the deck-in-line with the loading girder.
- .9 Repeat steps 1 through 8 until the span does not return to its original position after jacking. For every successive cycle, increase the weight versus the weight used in previous cycle. Total weight shall be added permanently along that side of the bridge as directed by the Departmental Representative.
- .10 Jack the bridge from the low side (side with balance wheel in contact) with a dial indicator positioned to indicate movement of the pivot bearing top weldment on the opposite side of the bearing from the jacks. Dial indicator to be on transverse centerline of the bridge. Determine the force required to initiate movement, after first eliminating any balance wheel contact, as it may affect the readings. Record this value as F north or F south accordingly.
- .11 Jack the bridge until just before the balance wheels opposite the jacks contact the balance wheel track.
- .12 Jack the bridge from the opposite side with a dial indicator positioned to indicate movement of the pivot top weldment on the opposite side of the bearing from the jacks. Dial indicator to be on transverse centerline of the bridge. Determine the force required to initiate movement of the pivot top weldment. Record this value as F north or F south accordingly.
- .13 Once the measurements are made, assign the larger as FT1 and the smaller as FT2.
- .14 Determine the transverse imbalance force using the following equation:
$$F_{ImbT} = (FT1 - FT2) / 2$$

- .15 Determine the required weight change at the transverse side of bridge using the following equation:
- $$W_T = F_{ImbT} (d/D)$$
- Where,
- F_{ImbT} = Transverse imbalance force at distance d (from step 13 and 14).
- d = Distance to jacks along transverse axis of bridge.
- D = Distance to added weight along transverse axis of bridge.
- W_T = Weight change added to the F_{T2} side of bridge or removed from the F_{T1} side of the bridge.
- Note: All weight changes shall be made so as to keep the total weight used to a minimum.
- .5 The balance shall be considered acceptable when the combined vectoral sum of the span imbalance in the longitudinal and transverse directions is within 6000 N-m and less than the static friction of the pivot bearing.
- .6 Report the required weight of balance material to the Departmental Representative for review. Furnish and install permanent weights in locations as directed by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 WORK INCLUDES .1 This section specifies requirements for clearing and grubbing.
- 1.2 RELATED REQUIREMENTS .1 Section 31 14 13 - Soil Stripping and Stockpiling.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- 1.3 REFERENCES .1 U.S. Environmental Protection Agency (EPA)/Office of Water
- .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .2 Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- .3 Ontario Ministry of the Environment Stormwater Management Planning and Design (2003).
- .4 Transportation Association of Canada (TAC) National Guide to Sediment and Erosion Control on Roadway projects (2005).
- 1.4 DEFINITIONS .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground
-

surface.

- 1.5 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
- .1 Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
- .2 Tree wound paint: one liter can with manufacturer's label.
- .3 Herbicide: one liter can with manufacturer's label.
- .3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Submit manufacturer's installation instructions.
- 1.6 QUALITY ASSURANCE .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.
- .2 Safety Requirements: worker protection.
- .1 Workers must wear gloves, respirators, dust masks long sleeved clothing, eye protection and protective clothing when applying herbicide materials.
- .2 Workers must not eat, drink or smoke while applying herbicide material.
- .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.
- 1.7 STORAGE AND PROTECTION .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses and root systems of trees which are to remain.
- .1 Repair damaged items to approval of Departmental Representative.
- .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.
- 1.8 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
- .1 Trim limbs and tops, and saw into
-

- saleable lengths.
- .2 Stockpile adjacent to site.
- .3 Remove other cleared and grubbed material as directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reused.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION
AND SEDIMENTATION
CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.

- .3 Notify utility authorities before starting clearing and grubbing.
 - .4 Keep roads and walks free of dirt and debris.
- 3.3 APPLICATION
- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and instructions and datasheet.
- 3.4 CLEARING
- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
 - .2 Clear as indicated or directed by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
 - .3 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
 - .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- 3.5 CLOSE CUT CLEARING
- .1 Close cut clearing to ground level to within 100 mm of ground surface.
 - .2 Perform close cut clearing by hand so that existing muskeg is not damaged.
 - .3 Cut off branches down trees overhanging area cleared as directed by Departmental Representative.
 - .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- 3.6 ISOLATED TREES
- .1 Cut off isolated trees as indicated or as directed by Departmental Representative at height of not more than 300 mm above ground surface.
 - .2 Grub out isolated tree stumps.
 - .3 Prune individual trees as indicated.
 - .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or
-

- more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.
- 3,7 UNDERBRUSH CLEARING .1 Clear underbrush from areas as indicated at ground level.
- 3.8 GRUBBING .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.
- 3.9 REMOVAL AND DISPOSAL .1 Remove cleared and grubbed materials to disposal area designated by Departmental Representative.
- .2 Burning and burying of cleared and grubbed material will not be permitted.
- 3.10 FINISHED SURFACE .1 Leave ground surface in condition suitable for immediate stripping of topsoil to approval of Departmental Representative.
- 3.11 CLEANING .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- 1.2 REFERENCES .1 U.S. Environmental Protection Agency (EPA)/Office of Water
.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
.2 PCA Environmental Standards and Guidelines Document (2017).
.3 Environment Canada
.4 When conflicts occur between EPA and Environment Canada, the more stringent requirement shall apply.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 STRIPPING OF TOPSOIL .1 Ensure that procedures are conducted in accordance with applicable federal, provincial and municipal requirements.
.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
.3 Handle topsoil only when it is dry and warm.
.4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.
.5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.
.6 Strip topsoil to depths as indicated and to satisfaction of Departmental Representative.
.1 Avoid mixing topsoil with subsoil.
.7 Pile topsoil in berms in locations as directed by Departmental Representative.
.1 Stockpile height not to exceed 2 m.
.8 Dispose of unused topsoil as indicated and in accordance with all applicable federal, municipal and provincial regulations.
.9 Protect stockpiles from contamination and compaction.

- .10 Cover topsoil that has been piled for long term storage with anchored waterproof and insulated tarps, as required to resist wind water and winter conditions. Utilize properly installed and maintained sediment barriers or devices to prevent erosion and sediment leaving the pile in accordance with applicable federal, provincial and municipal regulations, to the satisfaction of PCA.

- 3.2 PREPARATION OF GRADE
 - .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.
 - .1 Grade area only when soil is dry to lessen soil compaction.
 - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

- 3.3 PLACING OF TOPSOIL
 - .1 Place topsoil only after Departmental Representative has accepted subgrade.
 - .2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
 - .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
 - .4 Cultivate soil following spreading procedures.

- 3.4 CLEANING
 - .1 Proceed in accordance with Section 01 74 11 - Cleaning.
 - .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 35 43 - Archaeological, Cultural and Environmental Procedures
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- 1.2 REFERENCES .1 ASTM International
- .1 ASTM D 698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³)
- .2 Underwriters Laboratories of Canada (ULC)
- 1.3 SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
- .1 Construction Waste Management:
- .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
- .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
- .3 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
- 1.4 EXISTING CONDITIONS .1 Examine subsurface investigation report which is included in Appendix B.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan.
- .3 Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Fill material: Type Granular B in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading

installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.
- .2 Commence topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .3 Strip topsoil to depths as directed by Departmental Representative. Rototill weeds and grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil as directed by Departmental Representative.

3.3 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Slope rough grade away from building 1:50 minimum.
- .3 Grade ditches to depth as directed.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .5 Compact filled and disturbed areas to corrected maximum dry density to ASTM D 698, as follows:
 - .1 95% under landscaped areas.
 - .2 100% under paved and walk areas.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid under a Cash Allowance by Departmental Representative in accordance with

Sections 01 29 83 - Payment Procedures for Testing
Laboratory Services and 01 45 00 - Quality Control.

- .2 Submit testing procedure, frequency of tests, testing laboratory as designated by ULC or certified testing personnel to Departmental Representative for approval.
- 3.5 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.6 PROTECTION
- .1 Protect and transplant existing fencing, trees, landscaping, natural features, bench marks, pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
 - .2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 02 41 13.14 - Asphalt Paving Removal
 - .2 Section 32 11 16.01 - Granular Sub Base
 - .3 Section 32 11 23 - Aggregate Base Courses
- 1.2 REFERENCES
- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-17, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63(2007)e2 Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c.33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.
 - .4 Ontario Provincial Standard Specification (OPPS) for Roads and Public Work Ministry of Transportation (MTO), latest edition.
- 1.3 DEFINITIONS
- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95m³-1.15m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.
 - .2 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters
-

in any dimension.

- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .6 Unsuitable materials:
 - .1 Weak, chemically unstable, wet and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318-17e1, and gradation within limits specified when tested to ASTM D422-63(2007)e2 and ASTM C136-14: Sieve sizes to CAN/CGSB-8.2-M88.
 - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
 - .3 Coarse grained soils Containing more than 20 % by mass passing 0.075 mm sieve.
- .7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control: in accordance with Section 01 45 00 -Quality Control:
 - .1 Submit to Departmental Representative testing results and reports as described in Part 3 of this section.
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of work.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source(s) of fill materials and provide access for sampling.

1.5 QUALITY ASSURANCE

- .1 For design of any temporary structures submit design and supporting data at least 2 weeks prior to installation or

construction.

- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
 - .3 Keep design and supporting data on site.
 - .4 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada to design and inspect shoring, bracing and underpinning required for Work.
- 1.6 EXISTING CONDITIONS
- .1 Examine geotechnical report prepared by SNC-Lavalin, dated January 17, 2017, Ref No. 16-2150-29, attached in Appendix B.
 - .2 Existing buried utilities and structures:
 - .1 Before commencing work obtain all required digging permits from local utilities and/or authorities, and verify and establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations and/or structures: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .1 Prior to beginning excavation Work, notify Departmental Representative or authorities to clearly mark such locations to prevent disturbance during Work.
 - .2 Confirm locations of buried utilities by hand digging or careful test excavations in presence of Departmental Representative. Hand dig all cables one metre either side of cable prior to machine excavation.
 - .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .4 Where unidentified utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or otherwise disturbing utilities or structures.
 - .5 Record location of maintained, re-routed and abandoned underground lines.
 - .5 Existing surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing fencing, trees and other plants, service poles, wires, lighting fixtures, pavement, survey benchmarks and monuments, and all other surface features which may be affected by Work.
 - .2 Protect existing surface features from damage while
-

Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

- .3 Protect existing asphalt and concrete pavements which may be affected by Work from damage while work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .4 Where required for excavation, cut roots or branches as directed by Departmental Representative.

1.7 SHORING,
BRACING, AND
UNDERPINNING

- .1 Shoring, Bracing or underpinning may be required to prevent undermining of adjacent structures, underground utilities and/or traffic areas.
- .2 Comply with safety requirements and applicable local legislation to protect existing features.
- .3 Engage services of qualified Professional Engineer who is registered in the Province of Ontario to design and inspect cofferdams, shoring, bracing and underpinning required for work.
- .4 At least 2 weeks prior to commencing work, submit design and supporting data.
- .5 Design and supporting data submitted to bear the stamp and signature of qualified Professional Engineer licensed in the Province of Ontario.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Granular A and Granular B Materials:
 - .1 Granular A in accordance with OPSS Volume 2, Specification No. 1010.
 - .2 Granular B - Type 1 in accordance with OPSS Volume 2 Specification No. 1010.
 - .3
- .2 Select Backfill Material: from excavations or other sources, approved by the Departmental Representative for use intended, dry, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious or unsuitable materials.
- .3 Unshrinkable Fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 1.0 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 h.
 - .4 Concrete aggregates: to CAN/CSA-A23.1.
 - .5 Portland cement: Type GU.
 - .6 Slump: 150 minimum.

PART 3 - EXECUTION

3.1 SITE
PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Sawcut pavement neatly along limits of proposed removal

in order that surface may break evenly and cleanly in accordance with Section 02 41 13.14 - Asphalt Paving Removal.

- .3 Install silt fences in accordance to Ontario Provincial Standards (OPS) for Roads and Public Works, Ministry of Transportation (MTO), latest edition.
- 3.2 STOCKPILING
- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
 - .2 Protect fill materials from contamination.
 - .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.
- 3.3 COFFERDAMS, SHORING, BRACING AND UNDERPINNING
- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements and Health and Safety Act for the Province of Ontario.
 - .2 Obtain permit from authority having jurisdiction for any temporary diversion or pumping of water course.
 - .3 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .4 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.
- 3.4 DEWATERING
- .1 Keep excavations free of water while Work is in progress.
 - .2 As part of Environmental Management Plan contractor to submit for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
 - .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
 - .4 Protect open excavations against flooding and damage due to surface run-off.
 - .5 Dispose of water in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures to approved runoff areas and in manner not detrimental to public and private property, existing facilities, or
-

portion of Work completed or under construction.

- .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
 - .6 Provide flocculation tanks, sealed containment basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.
- 3.5 EXCAVATION
- .1 Excavate to lines, grades, elevations and dimensions as indicated.
 - .2 For foundation and structures:
 - .1 Excavate as required to carry out work, in all materials encountered, to level of competent bearing stratum, described in geotechnical report as compact to dense glacial till or 'bedrock'. Do not disturb soil or rock below bearing surface.
 - .2 Coordinate inspection by professional geotechnical engineer designated by Departmental Representative, as required.
 - .3 If bearing surface is unsatisfactory, perform additional excavation as directed by Departmental Representative. Replace excavated material to satisfaction of Departmental Representative.
 - .1 Obtain Departmental Representative's approval of completed excavation.
 - .4 Remove concrete and asphalt paving, demolished foundations and rubble and other obstructions encountered during excavation.
 - .5 Excavation must not interfere with normal 1:1 (H:V) spray of bearing capacity of adjacent foundations and traffic areas. If interference will occur, excavation must be shored, braced or underpinned as described elsewhere in this specification.
 - .6 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
 - .7 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
 - .8 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
 - .9 Restrict vehicle operations directly adjacent to open trenches.
 - .10 Dispose of surplus and unsuitable excavated materials
-

off-site in accordance with applicable provincial and municipal regulations.

- .11 Do not obstruct flow of surface drainage or natural watercourses. Diversions of flow are to be submitted in detailed plan and approved by Departmental Representative and other authorities before proceeding.
 - .12 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
 - .13 Notify Departmental Representative when bottom of excavation is reached and/or appears unsuitable and proceed as directed by Departmental Representative.
 - .14 Obtain Departmental Representative's approval of completed excavation.
 - .15 If encountered, remove unsuitable material from excavation bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
 - .1 In areas occupied by foundations or structures, replace excavated material with Granular B compacted to not less than 100% Standard Proctor maximum dry density.
 - .16 Correct unauthorized over-excavation as follows:
 - .1 In areas not occupied by foundations or structures, replace excavated material with Select Backfill Material compacted to not less than 100% of Standard Proctor Maximum Dry Density.
 - .17 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
- 3.6 BACKFILL TYPES AND COMPACTION .1 Use types of backfill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698.
- .1 Granular A and Granular B: compact to 100% of maximum dry density.
 - .2 Select Backfill Material: compact to 95% of maximum dry density.
- 3.7 BACKFILLING .1 Do not proceed with backfilling operations until completion of following:
- .1 Departmental Representative has inspected and approved installations.
 - .2 Removal of concrete formwork.
 - .3 Removal of shoring and bracing;
 - .4 Backfilling of voids with satisfactory soil material.
-

- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .4 Place backfill material in uniform layers not exceeding 200 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. Departmental Representative may authorize thicker lifts if it can be shown specified compaction can be achieved.
 - .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and obtain approval from Departmental Representative.
 - .5 Place unshrinkable fill in areas as indicated or directed by Departmental Representative. Consolidate and level unshrinkable fill with internal vibrators.
- 3.8 RESTORATION
- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
 - .2 Replace topsoil, seed and fertilize as indicated.
 - .3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
 - .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.
 - .5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
 - .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling
- 1.2 REFERENCES .1 American Society for Testing and Materials (ASTM)
- .1 ASTM C 117-17, Standard Test Methods for Material Finer Than 75-micro m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM D6928-17, Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .3 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .6 ASTM D1883-16, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- Ontario Provincial Standard Specification.
- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
- Divert unused granular material from landfill to local facility to the satisfaction of the Departmental Representative.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Granular subbase material: Granular B Type I modified in accordance with OPSS MUNI 1010 - Material Specification for aggregates - base, subbase, select subgrade, and backfill material.

PART 3 - EXECUTION

- 3.1 PLACING .1 Place granular sub-base after subgrade is to the satisfaction of the Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.

- .3 Ensure no frozen material is placed.
 - .4 Place material only on clean, unfrozen surface, free from snow or ice.
 - .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
 - .6 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .8 Remove and replace portion of layer in which material has become segregated during spreading.
- 3.2 COMPACTION
- .1 Compaction equipment to be capable of obtaining required material densities.
 - .2 Compact to density of not less than 100% of Maximum Dry Density in accordance with ASTM D 698.
 - .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
 - .4 Apply water as necessary during compaction to obtain specified density.
 - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers to the satisfaction of the Departmental Representative.
 - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.3 SITE TOLERANCES
- .1 Finished sub-base surface to be within 25 mm of elevation as indicated but not uniformly high or low.
- 3.4 PROTECTION
- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 16.01 - Granular Sub-Base
- 1.2 REFERENCES .1 American Society for Testing and Materials International (ASTM):
- .1 ASTM C117-17, Standard Test Methods for Materials Finer Than 75-micron Sieve in Mineral Aggregates by Washing.
- .2 ASTM D6928-17, Standard Test Method for Resistance of coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
- .3 ASTM C136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .5 ASTM D1883-16, Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.
- .6 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Ontario Provincial Standard Specification (OPSS).
- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Divert unused granular material from landfill to local facility to satisfaction of Departmental Representative.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Granular base material: Granular A Material in accordance with OPSS MUNI 1010 - Material Specification for aggregates - base, subbase, select subgrade, and backfill material.

PART 3 - EXECUTION

- 3.1 EXECUTION .1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.
- .2 Placing:
- .1 Construct granular base to depth and grade in

- areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .5 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compacting:
- .1 Compaction equipment to be capable of obtaining required material densities.
 - .2 Compact to density not less than 100% of Maximum Dry Density in accordance with ASTM D 698.
 - .3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .4 Apply water as necessary during compacting to obtain specified density.
 - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers to the satisfaction of the Departmental Representative.
 - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.2 SITE TOLERANCES .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.
- 3.3 PROTECTION .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 32 12 16.01 - Asphalt Paving - Short Form.
- 1.2 REFERENCES .1 American Society for Testing and Materials International (ASTM):
.1 ASTM D140-2016, Standard Practice for Sampling Bituminous Materials.
.2 ASTM D244-09(2017), Standard Test Methods and Practices for Emulsified Asphalts.
.2 Ontario Provincial Standard Specification (OPSS).
- 1.3 SUBMITTALS .1 If requested, submit samples in accordance with Section 01 33 00 - Submittal Procedures.
.2 If requested, submit two (2) - 1 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars, bottles made with plastic or plastic lined cans to Departmental Representative, at least two (2) weeks prior to beginning Work.
.3 Sample asphalt tack coat material to: ASTM D 140.
.4 As required provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D 140.
- 1.4 QUALITY ASSURANCE .1 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.
- 1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with ASTM D 140.
.2 Provide, maintain and restore asphalt tack coat material storage area.
- 1.6 WASTE MANAGEMENT AND DISPOSAL .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management And Disposal.
.2 Divert unused asphalt tack coat material from landfill to facility capable of recycling materials.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Emulsified asphalt: grade RS-1 to the requirements of OPSS.PROV 1103 - Material Specification for Emulsified Asphalt.
.2 Water: clean, potable, free from foreign matter.
- 2.2 EQUIPMENT .1 Equipment: in accordance with OPSS.PROV 308 -
-

Construction Specification for Tack Coating and Joint
Painting

PART 3 - EXECUTION

- 3.1 APPLICATION
- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
 - .2 Apply asphalt tack coat only on clean and dry surface.
 - .3 Dilute asphalt emulsion with water at 1:1 ratio for application.
 - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
 - .4 Apply asphalt tack coat evenly to pavement with a distributor at a rate as indicated in OPSS.PROV 308 as directed by the Departmental Representative and at a temperature not less than 20°C nor more than 70°C.
 - .5 Paint contact surfaces of existing abutting asphalt surface with thin, uniform coat of asphalt tack coat material.
 - .6 Do not apply asphalt tack coat when air temperature is less than 10°C or when rain is forecast within 2 hours of application.
 - .7 Apply asphalt tack coat only on unfrozen surface.
 - .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
 - .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
 - .10 Keep traffic off tacked areas until asphalt tack coat has set.
 - .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
 - .12 Permit asphalt tack coat to set before placing asphalt pavement.
 - .13 No more tack coat shall be applied than can be covered with asphalt pavement wearing surface in one day.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 32 12 16.01 - Asphalt Paving - Short Form.
- 1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION .1 Departmental Representative will supply:
.2 Asphalt prime material delivered to job site by tank truck in 205 L drums.
- 1.3 MEASUREMENT PROCEDURES .1 Asphalt prime will be measured in square metres at 15°C of diluted emulsified asphalt actually applied.
.2 Blotter Sand: supply of blotter sand will be measured by weight in tonnes.
.3 Application of Blotter Sand: application of blotter sand will be measured in cubic metres.
- 1.4 REFERENCE STANDARDS .1 ASTM International
.1 ASTM D 140/D 140M-16, Standard Practice for Sampling Bituminous Materials.
.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.
.2 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.5 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt prime coat and include product characteristics, performance criteria, physical size, finish and limitations.
.3 Samples:
.1 Submit two 4 L samples of asphalt prime proposed for use in new, clean, air tight sealed, wide mouth, plastic lined cans, to Departmental Representative, 2 weeks prior to commencing Work.
.2 Sample asphalt prime coat materials in accordance with ASTM D 140.
.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D 140.
- 1.6 QUALITY ASSURANCE .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this
-

Section.

1.7 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Arrange points of delivery and quantity to be shipped with vendor.
 - .2 Make deliveries during normal work hours.
 - .3 Include copy of orders and instructions respecting shipment upon request by Departmental Representative.
 - .4 Include suitable unloading facilities and unload asphalt as directed by the Departmental Representative.
 - .5 Provide, maintain and restore asphalt storage area.
- .3 Storage and Handling Requirements:
 - .1 Deliver, store and handle materials to ASTM D 140.
 - .2 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Store and protect asphalt prime coats from nicks, scratches, and blemishes.
 - .4 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Section 01 74 19 - Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIAL

- .1 Asphalt material: to CAN/CGSB-16.2 grade: SS-1.
- .2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
- .3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .2 Maintained at even temperature.
 - .1 Applied uniformly on variable widths of surface up to 5 m.
 - .2 Applied at controlled rates from 0.2 to 5.4

- L/m² with uniform pressure, and allowable variation from any specified rate not exceeding 0.1 L/m².
- .3 Distributed in uniform spray without atomization at temperature required.
- .2 Equipped with metre registering travel distance in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .1 Equipped with pump having flow metre graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator.
 - .1 Pump power unit to be independent of truck power unit.
 - .2 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .3 Temperature to be measured to nearest whole number.
 - .2 Equipped with accurate volume measuring device or calibrated tank.
 - .3 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .4 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
 - .5 Cleaned if previously used with incompatible asphalt material.
 - .3 Aggregate Spreader:
 - .1 Apply blotter sand to primed surfaces using roll type spreader, or rotating disc sander capable of applying aggregate at variable widths and at variable rates.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
 - 3.2 APPLICATION
 - .1 Proceed with application of tack coat only after receipt of written approval of granular base surface from Departmental Representative.
-

- .2 Anionic emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.
 - .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
 - .3 Apply diluted asphalt emulsion at rate directed by Departmental Representative.
 - .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
 - .3 Apply asphalt prime only on unfrozen surface.
 - .4 Apply asphalt tack coat only when air temperature is greater than 10°C and when rain is not forecast within 2 hours minimum of application.
 - .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
 - .6 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
 - .7 Prevent overlap at junction of applications.
 - .8 Do not prime surfaces that will be visible when paving is complete.
 - .9 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
 - .10 Keep traffic off primed areas until asphalt prime has cured.
 - .1 Control traffic in accordance with Section 01 35 00.06 - Special Procedures for Traffic Control.
 - .11 Permit prime to cure before placing asphalt paving.
- 3.3 USE OF SAND
BLOTTER
- .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
 - .2 Allow sufficient time for excess prime to be absorbed as directed by Departmental Representative.
 - .3 Apply second application of sand blotter as required.
 - .4 Do not roll blotter sand.
 - .5 Sweep and remove excess blotter material.
- 3.4 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
-

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Association of State Highway and Transportation Officials (AASHTO):
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
 - .2 Asphalt Institute (AI):
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
 - .3 ASTM International:
 - .1 ASTM C88-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123/C123M-14, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-15, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-14, Standard Test Method for Resistance to Degradation by Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D2489/D2489M-16, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .11 ASTM D3203/D3203M-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .12 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
 - .4 U.S. Environmental Protection Agency (EPA) / Office of Water:
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
-

- .5 Ontario Provincial Standard Specifications:
 - .1 OPSS.MUNI 1101 Material Specification for Performance Graded Asphalt Cement November 2013.
 - .2 OPSS 310 Hot Mix Asphalt November 2012.
 - .3 OPSS 1150 Material Specification for Hot Mix Asphalt November 2010.
 - .4 OPSS 1103 Material Specification for Emulsified Asphalt November 2012.
- 1.2 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furool viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.
 - .2 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Samples:
 - .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.
 - .2 Submit samples of following materials proposed for use 4 weeks prior to beginning Work.
 - .1 One 5L container of asphalt cement.
 - .2 1kg of hydrated lime.
 - .4 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.
 - .3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.
 - .4 Submit printed record of mix temperatures at end of each day.
- 1.3 DELIVERY,
STORAGE AND
HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
 - .2 Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.
 - .3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
-

- .4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.
- .5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .6 Stockpile crushed RAP separately in accordance with Section 31 14 13 as indicated where directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Asphalt surface course: to Ontario Provincial Standard Specification OPSS.MUNI 1150, November 2018 for type HL1. Maximum size aggregate 16 mm.
- .2 Asphalt binder course: to Ontario Provincial Standard Specification OPSS.MUNI 1150, November 2018 for HDBC. Maximum size aggregate 26.5 mm.
- .3 Primer: emulsified asphalt to Ontario Provincial Standard Specification OPSS.MUNI 1103, November 2016 for rapid setting type.

2.2 MIX DESIGN

- .1 Mix design to be approved in writing by Departmental Representative.
- .2 Mix design to be developed by testing laboratory approved in writing by Departmental Representative.
- .3 Design of mix: In accordance with Ontario Provincial Standard Specification (OPSS).

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Remove dust, contaminants, loose and foreign materials, oil and grease in designated areas.
- .2 Use rotary power brooms supplemented by hand brooming as required.
- .3 Where directed, remove to existing pavement level, sealing compound which has protruded excessively and dispose of removed material as directed.
- .4 Keep drainage system clear of loose and waste materials.

3.2 INSPECTION

- .1 Check graded grade for conformity with elevations and cross-sections before placing asphalt material.
- .2 Notify Departmental Representative of unsatisfactory conditions.

- .3 Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- .4 Excavate beyond limits indicated on drawings only upon written authorization from the Department Representative.
- .5 Correct unauthorized excavation at no extra cost by filling with Granular A material.

3.3 ASPHALT COURSE

- .1 Asphalt placement to Ontario Provincial Standard OPSS 310 November 2012.
- .2 Apply tack coat prior to the placement of asphalt at approximately 0.5L/m².
- .3 Place 100mm compacted asphaltic concrete base course in 2 50mm lifts, and 50mm of compacted asphaltic concrete surface course.
- .4 Minimum 7°C air temperature when placing mixture.
- .5 Minimum 118°C mixture temperature when spread.
- .6 Maximum 149°C mixture temperature at any time.
- .7 Compact each course with roller when it can support roller mass without undue cracking or displacement.
- .8 Roll until roller marks are eliminated. Compact to 97% laboratory density.
- .9 Keep roller speed slow enough to avoid mixture displacement.
- .10 Moisten roller wheels to prevent mixture adhesion.
- .11 Compact mixture with hot tampers in areas inaccessible to roller.
- .12 Finish surface true to grade and free from deviations exceeding 1:1000 when measured in any direction with a 3 m straight edge.

3.4 JOINTS

- .1 Cut back bituminous course to full depth in straight or curved lines as required to expose fresh vertical surfaces. Remove any broken or loose material.
 - .2 Paint exposed edge of asphaltic joints, edges of manholes and catch basin frames, curbs and similar items with asphalt primer prior to placing asphalt courses.
 - .3 Carefully place and compact hot asphaltic material against joints.
-

- 3.5 FINISH TOLERANCES
- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
 - .2 Finished asphalt surface not to have irregularities exceeding 5mm when checked with 4.5 m straight edge placed in any direction.
- 3.6 DEFECTIVE WORK
- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
 - .2 Repair areas showing checking, rippling, or segregation.
 - .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.
- 3.7 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES .1 Ontario Provincial Standard Specifications (OPPS).
- 1.2 DELIVERY .1 Supply calcium chloride as required to prevent blowing
STORAGE AND dust.
HANDLING .2 Deliver calcium chloride to site in moisture-proof bags,
bulk. Indicate name of manufacturer, name of product, net
weight or mass, and percentage of calcium chloride
guaranteed by manufacturer.
.3 Store bags of calcium chloride in weather- proof
enclosures.
- 1.3 WASTE .1 Separate and recycle waste materials in accordance with
MANAGEMENT AND Section 01 74 19 - Waste Management and Disposal.
DISPOSAL .2 Collect and separate plastic, paper packaging, and
corrugated cardboard in accordance with Waste Management
Plan.
.3 Place materials defined as hazardous or toxic in
designated containers.
.4 Fold up metal banding, flatten and place in designated
area for recycling.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Calcium chloride: requirements of OPSS.MUNI 2501 -
Material Specification for Calcium Chloride. Water:
clean, potable, free from foreign matter.

PART 3 - EXECUTION

- 3.1 APPLICATION .1 Apply calcium chloride and water with equipment approved
by Departmental Representative when directed by
Departmental Representative.
.2 Apply water with distributors equipped with means of
shut-off and with spray system to ensure uniform
application.

END OF SECTION

for reuse and recycling.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .2 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.
 - .3 Joint filler and Curing Compound: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .4 Granular base: material to Section 32 11 16.01 - Granular Sub-Base and Section 32 11 23 - Aggregate Base Courses.
 - .5 Non-staining mineral type form release agent: chemically active release agents containing compounds reacting with free lime to provide water-soluble soap.
 - .6 Curing Agent: to ASTM C 309, Type 1.
 - .7 Expansion Joint Filler: Premoulded bituminuous fibre board, conforming to ASTM D 1751.
 - .8 Tactile Walking Surface Indicators: Cast reinforced fiberglass with truncated domes to CSA B651.

PART 3 - EXECUTION

- 3.1 GRANULAR BASE
- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
 - .2 Place granular base material to lines, widths, and depths as indicated.
 - .3 Compact granular base in maximum 150 mm layers to minimum 95% of maximum density to ASTM D 698.
- 3.2 CONCRETE
- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
 - .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom side to side across sidewalk.
 - .3 Provide edging as indicated with 10 mm radius edging tool.
 - .4 Slip-form pavers equipped with string line system for
-

line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

- 3.3 TOLERANCES .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.
- 3.4 EXPANSION AND CONTRACTION JOINTS .1 Install tooled transverse contraction joints after floating, when concrete stiff, but still plastic, at intervals of 1.5 m.
- .2 Install expansion joints as indicated.
- .3 When sidewalk adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- 3.5 ISOLATION JOINTS .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints as indicated.
- .3 Seal isolation joints with sealant approved by Departmental Representative.
- 3.6 TACTILE WALKING SURFACE INDICATORS .1 Install tactile walking surface indicators at curb ramp edges, where indicated on drawings and in accordance with local municipal by-laws.
- 3.7 CURING .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for minimum 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.
- 3.8 BACKFILL .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
- .3 Compact and shape to required contours as indicated.
- 3.9 LINSEED OIL TREATMENT .1 Apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters, after concrete has cured for specified curing time and when surface of concrete clean and dry.
- .2 Linseed oil mixture to consist of 50% boiled linseed oil
-

and 50% mineral spirits by volume.

- .3 Apply treatment when air temperature above 10 degrees C.
- .4 Apply first coat at 135 mL/m².
- .5 Apply second coat at 90 mL/m² when first coat has dried.

3.10 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.
 - .2 CAN/CGSB-1.74-01, Alkyde Traffic Paint.
 - .2 Green Seal Environmental Standards (GS):
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
 - .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- 1.2 SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .3 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 One 1 kg sample of glass beads.
 - .3 Sampling to MPI Painting Manual.
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Paint:
 - .1 To MPI -EXT 2.1B, Alkyd zone/traffic marking.
 - .2 Paints: in accordance with MPI recommendation for surface conditions.
 - .1 Paints: maximum VOC limit 100 g/L to SCAQMD Rule 1113 and to GS-11.
 - .3 Colour: to MPI listed, yellow and white.
 - .2 Thinner: to MPI listed manufacturer.
 - .3 Glass Reflective Beads: type suitable for application to wet paint surface for light reflectance.

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
 - .3 Proceed with Work only after unacceptable conditions have been rectified.
- 3.2 EQUIPMENT REQUIREMENTS
- .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
 - .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.
- 3.3 APPLICATION
- .1 Pavement markings is to match existing pavement markings.
 - .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
 - .3 Apply traffic paint evenly at rate of 3 m² /L.
 - .4 Do not thin paint unless approved by Departmental Representative.
 - .5 Symbols and letters to dimensions indicated.
 - .6 Paint lines: of uniform colour and density with sharp

edges.

- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
 - .8 Apply glass beads at rate of 0.5 kg/l of painted area immediately after application of paint.
- 3.4 TOLERANCE
- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- 3.5 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- 3.6 PROTECTION OF COMPLETED WORK
- .1 Repair damage to adjacent materials caused by pavement marking application.
 - .2 Protect pavement markings until dry.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 14 13 - Soil Stripping and Stockpiling
 - .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling
 - .3 Section 32 92 23 - Sodding
- 1.2 REFERENCES
- .1 Agriculture and Agri-Food Canada
 - .2 The Canadian System of Soil Classification, Third Edition, 1998.
 - .3 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Quality control submittals :
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in Part 2.2 - Source Quality Control.
- 1.4 QUALITY ASSURANCE
- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

PART 2 - PRODUCTS

- 2.1 TOPSOIL
- .1 Topsoil to come from material previously stockpiled on site.
 - .2 Additional topsoil for seeded areas: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .4 Consistence: friable when moist.

- 2.2 SOURCE QUALITY CONTROL
- .1 Contractor is responsible for amendments to supply topsoil as required.
 - .2 Provide for soil testing by recognized testing facility for PH, P and K, and organic matter.
 - .1 Soil sampling, testing and analysis to be in accordance with Ontario Provincial standards.

PART 3 - EXECUTION

- 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL
- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- 3.2 STRIPPING OF TOPSOIL
- .1 Strip topsoil in accordance with Section 31 14 13 - Soil Stripping and Stockpiling.
- 3.3 PREPARATION OF EXISTING GRADE
- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
 - .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
 - .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.
- 3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL
- .1 Place topsoil after Departmental Representative has accepted subgrade.
 - .2 Spread topsoil in uniform layers not exceeding 150 mm.
 - .3 Manually spread topsoil/planting soil around trees, shrubs and obstacles.
- 3.5 FINISH GRADING
- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
-

- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

- 3.6 ACCEPTANCE .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

- 3.7 SURPLUS MATERIAL .1 Dispose of materials not required where directed by Departmental Representative off site.

- 3.8 CLEANING .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Division 1 sections
.2 Archaeological, Cultural and Environmental Procedures.
- 1.2 ADMINISTRATIVE REQUIREMENTS .1 Scheduling:
.1 Schedule sod laying to coincide with preparation of soil surface.
.2 Schedule sod installation when frost is not present in ground.
.2 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 31 19 - Project Meetings.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for sod, geotextile and fertilizer and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
.3 Samples:
.1 Submit:
.1 Sod for each type specified.
.1 Install approved samples in square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.
.2 Bio-degradable geotextile fabric.
.3 0.5 kg container of each type of fertilizer used.
.2 Obtain approval of samples by Departmental Representative.
.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.
.5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with
-

manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with supplier's recommendations.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Management and Disposal.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Sod, stakes, water and fertilizer in accordance with OPSS 803.PROV - Construction Specification for Sodding.
- 2.2 SOURCE QUALITY CONTROL .1 Obtain written approval from Departmental Representative of sod at source.
 - .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sod installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 PREPARATION .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.
 - .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
 - .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod.
 - .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other

- deleterious materials; off site in accordance with Section 01 74 19 - Waste Management and Disposal.
- 3.3 SOD PLACEMENT .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20°C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- 3.4 SOD PLACEMENT .1 Install and secure geotextile fabric in areas indicated, in ON SLOPES AND PEGGING accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:
- .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
- .2 Not less than 3-6 pegs per square metre.
- .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
- .4 Drive pegs to 20 mm above soil surface of sod sections.
- 3.5 FERTILIZING .1 Apply Fertilizer in accordance with OPSS. PROV 803 - PROGRAM Construction Specification for Sodding.
- 3.6 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for reuse compost and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .1 Remove recycling and compost containers and bins from site and dispose of materials at appropriate facility.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
-

-
- 3.7 PROTECTION BARRIERS .1 Protect newly sodded areas from deterioration with snow fence on rigid frame as directed by Departmental Representative.
- .2 Remove protection after inspection as directed by Departmental Representative.
- 3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm.
- .4 Maintain sodded areas weed free 95%.
- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .1 Temporary barriers or signage to be maintained where required to protect newly established sod.
- 3.9 ACCEPTANCE .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
- .1 Sodded areas are properly established.
- .2 Sod is free of bare and dead spots.
- .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
- .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.
- When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.
- 3.10 MAINTENANCE DURING WARRANTY PERIOD .1 Perform following operations from time of acceptance until end of warranty period:
- .1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.
- .3 Cut grass and remove clippings that will smother grass as directed by Departmental Representative as follows:
- .1 Turf Grass Nursery Sod:
- .1 50 mm during normal growing conditions.
-

- .2 Cut grass at 2 week intervals or as directed by Departmental Representative, but at intervals so that approximately one third of growth is removed in single cut.
- .3 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .4 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 31 23 33.01 - Excavation, Trenching & Backfilling
 - .2 Section 01 33 00 - Submittal Procedures
 - .3 Section 31 22 13 - Rough Grading
 - .4 Section 31 37 00 - Rip-Rap
- 1.2 REFERENCE STANDARDS
- .1 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM D 698-10, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .3 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-M89 (April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
 - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
 - .5 ASTM D3786 / D3786M - 13 Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
 - .6 ASTM D 4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - .7 ASTM D 4716-14, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .8 Master Municipal Construction Documents, latest edition.
- 1.3 ADMINISTRATIVE REQUIREMENTS
- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Provide manufacturer's instructions, printed
-

product literature and data sheets for geotextiles and geomembranes and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Submit to Departmental Representative copies of mill test data and certificate at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, fittings and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Product Data:
 - .1 Provide manufacturer's instructions, printed product literature and data sheets for geotextiles and geomembranes and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit manufacturer's certification that drain pipe materials meet requirements of this Section.
 - .4 Certification to be marked on pipe.
 - .5 Submit manufacturer's test data that drain pipe materials meet requirements of this Section.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
 - .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new
 - .4 Ensure each individual roll of geosynthetic is wrapped and covered to protect fabric from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, debris and rodents.
 - .5 Use equipment that does not contact material itself during loading, unloading and handling. Slings or other lifting devices to provide adequate support without damaging material. Off-load in a minimum of steps directly to storage or installation area.
 - .6 Store all rolls on smooth, flat surfaces raised above ground that provide continuous support to rolls. Maintain additional protective cover if rolls are to
-

be stored in excess of 30 days.

- 1.6 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for reuse and recycling.
 - .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Plastic pipe and fittings: to BNQ 3624-115, nominal inside diameter [100] mm.
 - .2 Perforated plastic pipe and fittings: to [CAN/CSA-B1800]. Nominal pipe sizes 150mm.
 - .3 Granular filter material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Aggregate for French drain: open graded, hard, durable 19mm clear stone.
- 2.2 GEOTEXTILES
- .1 Geotextile material to be a polypropylene, staple fiber, needle-punched and non-woven conforming to the minimum requirements as follows:
 - .1 Physical properties:
 - .1 Elongation at break: 50 %.
 - .2 Grab tensile strength to ASTM D-4362: 712N.
 - .3 CBR Puncture to ASTM D6241 1824N.
 - .4 Trapezoidal Tear to ASTM D4533: 267N.
 - .2 Hydraulic properties:
 - .1 Apparent opening size (AOS): to ASTM D 4751, 0.212 mm.
 - .2 Permittivity: to ASTM D 4491, 2 sec -1.
 - .3 Water flow rate to ASTM D4491: 4482 L/M/M2.
 - .4 Factory seams: sewn in accordance with manufacturer's recommendations.
 - .2 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.-

PART 3 - EXECUTION

- 3.1 EXAMINATION
- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sub-drainage piping and geotextile material installation in accordance with manufacturer's written instructions.
 - .2 Visually inspect substrate in presence of Departmental

Representative.

- .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.
- 3.2 INSTALLATION
- GEOTEXTILES
- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.
 - .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
 - .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
 - .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
 - .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
 - .6 After installation, cover with overlying layer within 4 hours of placement.
 - .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- 3.3 CLEANING
- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.
- 3.4 PROTECTION
TRENCHING
- .1 Vehicular traffic not permitted directly on geotextile.
 - .2 Do excavation, trenching and backfilling in accordance with 31 23 33.01 - Excavating, Trenching & Backfilling.
 - .3 Place bedding material after approval of excavation by Departmental Representative.
- 3.5 INSTALLATION OF
PIPE SUB-DRAINS
- .1 Lay pipe drains on prepared bed, true to line and grade with invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with bed throughout full length.
 - .2 Begin laying at outlet and proceed in upstream direction.
 - .3 Lay perforated pipes with perforations downwards.
 - .4 Lay bell and spigot pipe with bell ends facing upstream.
 - .1 Do not mortar joints.
-

- .5 Make joints tight in accordance with manufacturer's instructions.
- .6 Make watertight connections to existing drains, new or existing manholes and catch basins where indicated or as directed by Departmental Representative.
- .7 Surround pipe with bedding gravel and compact as directed by Departmental Representative.
- .8 Surround and cover drain with filter material in uniform 150 mm layers as indicated.
- .9 Wrap or sleeve perforated pipe with geotextile filter as indicated.
- .10 Backfill remainder of trench to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .11 Do not place bedding surround and backfill materials in frozen condition.
- .12 Protect sub-drains against flotation during installation.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Measurement procedures.
- .2 Waste management and disposal.
- .3 Materials.
- .4 Installation.
- .5 Removal and salvage.
- .6 Cleaning.
- 1.2 REFERENCES .1 American Society for Testing and Materials (ASTM).
- .1 ASTM A276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
- .2 ASTM B209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM B210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.
- .4 ASTM B211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.
- .2 Canadian General Standards Board (CGSB)
- .1 CGSB1-GP-12c-65, Standard Paint Colours:
- .2 CAN/CGSB-1.28-M89, Alkyd, Exterior House Paint.
- .3 CAN/CGSB-1.59-M89, Alkyd, Exterior Gloss Enamel.
- .4 CAN/CGSB-1.94-M89, Xylene Thinner (Xylol)
- .5 CAN/CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.
- .6 CAN/CGSB-1.104-M91, Semigloss Alkyd Air Drying and Baking Enamel.
- .7 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
- .8 CGSB 1-GP-189M-78, Primer, Alkyd, Wood, Exterior.
- .9 CGSB 31-GP-3M-88, Corrosion Preventative Compound, Cold Application, Soft Film.
- .10 CGSB 62-GP-9M-80, Prefabricated Markings, Positioning, Exterior, for Aircraft Ground Equipment and Facilities.
- .11 CGSB 62-GP-11M-78, Marking Materials, Retroreflective, Enclosed Lens, Adhesive Backing.
- .3 Canadian Standards Association (CSA)
- .1 CAN/CSA-G40.21-M92, Structural Quality Steels.
- .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-080 Series-M89, Wood Preservation.
- .4 CSA 0121-M1978, Douglas Fir Plywood.
- .5 CSA W47.2-M1987, Certification of Companies for Fusion Welding of Aluminum.CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped.
-

- .4 Ontario Provincial Standard Specification (OPSS)
- 1.3 WASTE MANAGEMENT AND DISPOSAL
 - .1 Separate and recycle waste materials in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
 - .2 Divert unused metal and/or plastic materials to recycling facility approved by Departmental Representative.
 - .3 Damaged signs and posts from any removals to be transported to recycling facility approved by the Departmental Representative.

PART 2 - PRODUCTS

- 2.1 SIGNS
 - .1 Signs as indicated on drawings.
- 2.2 MATERIALS
 - .1 All materials shall be in accordance with OPSS 2001 - Material Specification for Signs.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - .1 The Contractor shall load, haul and install posts and existing signs (see detail sheet for typical sign) and bases in the following manner:
 - .1 The Contractor is responsible for locating power/telephone/gas lines/services/utilities at all proposed sign locations.
 - .2 The Contractor is responsible for layout and measurements to ensure signs are installed as per drawings and as directed by the Departmental Representative.
 - .3 Sign bases: Excavate hole for the post at the location and depth provided by the Departmental Representative. Using some of the excavated materials, level and compact bottom of hole. Place post with one side parallel to the edge of asphalt and level.
 - .4 Adjust the post height by using a cut off saw. All post cuts will be determined in the field by the Departmental Representative. The Departmental Representative will measure existing elevations at each site and calculate the cuts needed. The Contractor is required to provide the Departmental Representative with a minimum of 48 hours notice in order to perform the calculations.
 - .5 Assemble the signs on the forks on the ground. Slide forks onto posts and place the cap.
 - .6 Drill 1 hole in the base sleeves and posts for ½" bolts, as shown in the standard OPSS detail sheet for sign posts and as verified by the Departmental Representative, and shim to plumb if necessary.
 - .7 Bases must be perfectly plumbed. Vertical and horizontal tolerances for the base are 0.075m.

Tolerance for the plumb of the posts is 0.01 m per 1.0 m or ¼" on a two foot carpenters level. Tolerances for the signs are 0.075 m for distance from asphalt and 0.075 m for height above white line.

- .8 The Contractor is responsible for hauling all materials to and from each work site.
- .9 Landscape so the top of the base is flush or 25 mm above finished grade.
- .10 Remove all excess material on site including, boulders larger than 100 mm.
- .11 All signs are to be covered until the Departmental Representative advises to uncover.

3.2 CLEANING

- .1 Upon completion of installation remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Measurement procedures.
.2 Waste management and disposal.
.3 Materials.
.4 Installation.
.5 Removal and salvage.
.6 Cleaning.
- 1.2 REFERENCES .1 Ontario Provincial Standard Specification (OPSS)
.1 OPSD 2215.030
.2 OPSD 2220.010
.3 OPSD 2508.010 (steel pole shall replace sectional steel pole in this OPSD)
.4 OPSD 2200.01
.5 OPSD 2215.02
.6 OPSD 2215.03
.7 OPSD 2508.010
.8 OPSD 2524.010
.9 OPSD 2508.010
- 1.3 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Section 01 35 43 - Archaeological, Cultural and Environmental Procedures.
.2 Divert unused metal and/or plastic materials to recycling facility approved by Departmental Representative.
.3 Damaged Traffic Signals from any removals to be transported to recycling facility approved by the Departmental Representative.
- 1.4 ELECTRICAL WORKS - GENERAL SPECIFICATIONS .1 OPSS.PROV 106, November 2008 shall apply. OPSS.106.07.02 has been amended and extended as follows:
.1 The contractor shall obtain unique permits for all proposed electrical services and new traffic signal systems.
.2 The Contractor is required to notify the Departmental Representative a minimum of three (3) business days prior to scheduled testing/inspection in accordance with CP 601.02.
.3 A copy of all permits, inspection reports and certificates shall be submitted to the Departmental Representative prior to the commencement of work and/or the energizing of systems. ESA Certificate of Inspection for Hydro service and ESA Certificate of
-

Inspection for new traffic signals shall be submitted to the Departmental Representative three (3) business days prior to scheduled turn-on.

- .4 No additional payment above and beyond the contract Price will be made for Permits or Connection Fees.

PART 2 - PRODUCTS

- 2.1 Traffic Signals .1 Traffic Signals/Lights as indicated on drawings.
- 2.2 MATERIALS .1 All materials shall be in accordance with OPSS 2001 - Material Specification for Signs.
- 2.3 Contractor Supplied Equipment .1 Contractor shall supply the type of equipment as specified in the Contract Documents and the City of Peterborough Electrical Specifications. Where noted "or approved equivalent", the contractor may submit a request to the Departmental Representative to substitute the specified equipment with a different brand, make or model. By making this request it is the sole responsibility of the contractor to provide detailed justification to deviate from the specified equipment, relevant product specifications, independent test results, and sample product for the Departmental Representative's review.
 - .1 If the Departmental Representative has no experience with the proposed product or has any concerns with the products performance or longevity, the Departmental Representative will decline the request and the Contractor shall provide the equipment as specified. If the Departmental Representative can easily satisfy themselves that the proposed substitute product is equivalent, the request may be approved. Decision accept or reject a request to substitute will be at the discretion of the Departmental Representative without dispute.
 - .2 The Contractor shall at no time supply and install equipment that has not been specified or approved by the Departmental Representative or delay the progress of work based on a request to substitute.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Supply and Installation of Base Mounted Steel Pole. OPSS 615, November 2008 shall apply except as amended and extended herein.
 - .1 OPSS 615.05.03 has been amended and extended as follows:
 - .1 Steel poles shall be octagonal tapered steel traffic poles as manufactured by Valmont Industries, Inc. or Spina's Steel

- Workers Co., Ltd. or approved equivalent.
The poles shall be octagonal, non-frangible base, hot dipped galvanized steel and are to be supplied complete with galvanized hand hole covers and pole caps. Pole are to be 7.0m in height.
- .2 Where poles are perforated for cables or cut for any reason, they shall be treated with a zinc rich compound and fitted with rubber grommets.
- .2 OPSS 615.10 has been amended and extended as follows:
 - .1 Payment at the contract price shall be full compensation for all labour, equipment and materials necessary to Supply and Install Steel Pole Base Mounted as shown on the Contract Drawings.
- .2 Supply and Install Concrete Footing for Base Mounted Pole. OPSS 616, November 2008 shall apply except as amended and extended herein.
 - .1 Payment at the contract price shall include all labour, equipment and material necessary to construct footings for base mounted poles as shown on the Contract Drawings in accordance with OPSD 2200.01. Anchor assemblies shall be installed in accordance with OPSD 2215.02 as amended to specify a Richmond type anchor.
 - .2 Testing and sampling of concrete shall be in accordance with CP351.01. OPSS 616.10 has been amended and extended as follows:
 - .1 All pole base footings shall be augured, hydro vacuumed or hand dug. No excavator shall be used. The unit price for pole footings in grass boulevards shall also include restoration with topsoil to finish grade.
 - .2 Payment at the contract price shall be full compensation for all labour, equipment and materials necessary to Supply and Install Concrete Footing for base mounted pole as shown on the Contract Drawings.
- .3 Supply and Install Traffic Signal Double Arm Bracket OPSS 620, November 2007 shall apply except as amended and extended herein.
 - .1 OPSS 620.10 has been amended and extended as follows:
 - .1 Payment at the contract price shall be full compensation for all labour, equipment and materials necessary to Supply and Install Aluminum Double Arm Bracket as shown on the Contract Drawings.
-

- .4 OPSS 620, November 2007 shall apply except as amended and extended herein.
 - .1 OPSS 620.07.02.07 has been amended and extended as follows:
 - .1 Riser cables shall be connected to LED modules with insulated wing nut vibration connectors.
 - .2 Payment at the contract price shall be full compensation to Supply and Install Traffic Signal Heads as shown on contract drawings. The unit price bid shall also include but not limited to yellow polycarbonate housing and backboard, visors, Excellence Opto. Inc. LED Modules 12" Red (TRV-R12SG-D2T), 12" Amber (TRV-Y12SG-D1T), 12" Green (TRV-G12SG-D2T), 8" Amber (TRV-Y08SG-D1T), 8" Green (TRV-G08SG-D1T), 12" Bi-modal Arrow (TRA-B12DD-1W) or approved equivalent, Fortran PLU451 plumbizer kit, grounding, 7/C#14AWG conductor riser with minimum 19 strands to pole base including all connections in accordance with OPSS 2409.05.01.

3.2 CLEANING

- .1 Upon completion of installation remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

APPENDIX A

PARKS CANADA OCCUPATIONAL HEALTH & SAFETY (OH&S)
ATTESTATION FORM

Attestation and Proof of Compliance with Occupational Health and Safety (OH&S)

Submission of this completed form, satisfactory to Parks Canada, is a condition of gaining access to the work place.

Instructions:

Prime contractor must sign this form for all projects undertaken at Parks Canada work places.

This form is to be administered by the Project Manager and completed by the Prime Contractor AFTER contract award.

Parks Canada recognizes that federal OH&S legislation places certain specific responsibilities upon Parks Canada as owner of the work place. In order to meeting those responsibilities, Parks Canada is implementing a contractor safety regime that will ensure that roles and responsibilities assigned under Part II of the *Canada Labour Code* and the *Canada Occupational Health and Safety Regulations* are implemented and observed when involving contractor(s) to undertake works in Parks Canada work places.

Parks Canada Responsible Authority / Project Lead	Address	Contact Information
Project Manager / Contracting Authority (delete as required)		
Prime Contractor		
Subcontractor(s) (add additional fields as required)		

Location of Work:

General Description of Work to be Completed:

Mark "Yes" where applicable.

	A meeting has been held to discuss hazards and access to the work place and all known and foreseeable hazards have been identified to the contractor and/or subcontractor(s).
	The contractor and/or its subcontractor(s) will comply with all federal and provincial/territorial legislation and Parks Canada's policies and procedures, regarding occupational health and safety.
	The contractor and/or its subcontractor(s) will provide all prescribed safety materials, equipment, devices and clothing.
	The contractor and/or its subcontractor(s) will ensure that its employees are familiar with and use all prescribed safety materials, equipment, devices and clothing at all times.
	The contractor and/or its subcontractor(s) will ensure that its activities do not endanger the health and safety of Parks Canada employees.
	The contractor and/or its subcontractor(s) has inspected the site and has carried out a hazard assessment and has put in place a health and safety plan and informed its employees accordingly, prior to the commencement of the work.
	Where a contractor and/or its subcontractor(s) will be storing, handling or using hazardous substances in the work place, it will place warning signs at access points warning persons of the presence of the substances and any precautions to be taken to prevent or reduce any hazard of injury or death.
	The contractor and/or its subcontractor(s) will ensure that its employees are instructed in respect of any emergency procedures applicable to the site.

I, _____ (contractor), certify that I have read, understood and attest that my firm, employees and all subcontractors will comply with the requirements set out in this document and the terms and conditions of the contract.

Name: _____ Signature: _____

Date: _____

APPENDIX B

GEOTECHNICAL REPORT





SNC • LAVALIN

Geotechnical Investigation Warsaw Road Swing Bridge Rehabilitation

Park Hill Road East
Peterborough, Ontario

SNC-LAVALIN TRANSPORTATION



INFRASTRUCTURE

01 | 17 | 2017

DRAFT REPORT > ORIGINAL

ref. 16-2150-29



SNC • LAVALIN

SNC-Lavalin GEM Ontario Inc.
1164 Clyde Court
Kingston, Ontario, Canada K7P 2E4
☎ 613.389.1781 📠 613.389.4204

Geotechnical Investigation Warsaw Road Swing Bridge Rehabilitation

Final Report

SNC-LAVALIN INC. – TRANSPORTATION DIVISION
Park Lane Terraces
5657 Spring Garden Road, Suite 200
Halifax, Nova Scotia B3J 3R4

Prepared by:

Dylan Hill, P.Eng.
Project Manager
Environment and Geoscience



Reviewed by:

Zuhtu S. Ozden, M.A.Sc., P.Eng.
Senior Geotechnical Engineer
Environment and Geoscience

Farsheed Bagheri, P.Eng.
Assistant Director - Ontario
Environment and Geoscience

Our Reference: 16-2150-29

March 23, 2017

Distribution: Mr. Normand Landry, P.Eng. – SNC Transportation
Mr. Todd Barkhouse, P.Eng. – SNC Transportation

(1 PDF copy)
(1 PDF copy)

N:\16DocMgr\2101-2200\2150 SNC Lavalin\16-2150-29 - Warsaw Road Swing Bridge\Report\16-2150-29 - Warsaw Road Swing Bridge Rehabilitation - SNC Transportation.pdf

Infrastructure



Table of Contents

NOTICE TO READER		i
1	Introduction	2
2	Method of Investigation	4
2.1	Fieldwork – Drilling Investigation	4
2.2	Borehole Location Surveying	4
2.3	Fieldwork – Geophysical Investigation	5
3	Subsoil Conditions	6
3.1	Topsoil	6
3.2	Silty Sand Fill	6
3.3	Silty Clay Fill	6
3.4	Wood Fragments/Sand Fill	7
3.5	Native Sandy Silt	7
3.6	Native Gravelly Sand	8
4	Laboratory Testing	9
4.1	Geotechnical Laboratory Testing	9
5	Groundwater Conditions	10
6	Discussion and Recommendations	11
6.1	General	11
6.2	Site Preparation	11
6.3	Excavation	12
6.4	Dewatering	13
6.5	Foundations	14
6.6	Engineered Fill	17
7	Closure	18
8	General Conditions and Limitations	19

List of tables

Table 1:	Borehole Locations and Ground Surface Elevations	4
Table 3:	Summary of Gradation Testing Results	9
Table 4:	Atterberg Limits Testing Results	9
Table 4:	Water Level Observations	10
Table 5:	Lateral Earth Pressure Parameters	12
Table 6:	Maximum Slope of Excavation for Soil Type	13
Table 7:	Recommended bearing Elevations – Shallow Foundations	14

List of Figures and Appendices

Appendix 1

Borehole Location Plan and Site Location Plan

Appendix 2

Record of Boreholes

Appendix 3

Geotechnical Laboratory Results

Appendix 4

Geophysical Investigation Report

This report consists of 48 pages including appendices and may not be reproduced in whole or in part without the permission of SNC-Lavalin GEM Ontario Inc.

NOTICE TO READER

This document contains the professional opinion of *SNC-Lavalin GEM Ontario Inc. (SNCL)* as to the matters set out herein, based on professional judgment and reasonable care. It is to be read in the context of the agreement (the “Agreement”) between *SNCL* and *SNC-Lavalin Inc. - Transportation Division* (herein after referred to as the “Client”), the methodology, procedures and techniques used *SNCL*’s assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SNCL has, in preparing the geotechnical parameters and recommendations, followed accepted methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual site geotechnical conditions will fall within the predicted range. However, no warranty should be implied as to the accuracy of estimates. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which *SNCL*’s opinions as set out herein are based, have not been verified by *SNCL*; *SNCL* makes no representation as to their accuracy and disclaims all liability with respect thereto.

SNCL disclaims any liability to third parties in respect of the publication, reference, quotation, or distribution of this report or any of its contents to and reliance thereon by any third party.

1 Introduction

SNC-Lavalin GEM Ontario Inc. (“SNCL”) was retained by SNC-Lavalin Inc. – Transportation Division (the “Client”) to conduct a geotechnical investigation for the proposed rehabilitation of the Warsaw Road Swing Bridge, located on Park Hill Road East, east of Canal Road, in Peterborough, Ontario (the “Site”).

The existing bridge consists of a 31 m long unequal-arm swing bridge supported on a pivot pier located on the west side of the Trent Severn canal. The east face of the pier forms a part of the canal wall. Two (2) cast-in-place concrete abutment structures are located on the west and east extents of the bridge on Park Hill Road East. Based on historical drawings provided by the Client, the exact founding condition of the pivot pier and abutments was unknown. It was possible that the pivot pier is supported on a larger mass concrete foundation of unknown width and depth.

We understand that there are several options proposed for the rehabilitation: a minor structural rehabilitation of the bridge superstructure only (i.e. foundations would remain ‘as-is’), a major structural rehabilitation of the superstructure and existing exposed foundations (i.e. above grade), as well as a complete replacement of the bridge including all foundations.



Figure 1 – Swing Bridge, from east of canal looking south west (Nov-2016)

The purpose of this geotechnical investigation was to obtain information on the subsurface conditions at the Site by means of advancing a limited number of boreholes, in-situ tests and laboratory tests of selected soil samples. Based on SNCL’s interpretation of the obtained field

information, recommendations are provided on the geotechnical aspects of the proposed rehabilitation.

The field work for this investigation was carried out on December 7th and 8th, 2016 and consisted of drilling a total of five (5) boreholes within the vicinity of the existing bridge structure. The boreholes were advanced under the full-time supervision of experienced geotechnical personnel from SNCL. Prior to the drilling works, a geophysical investigation was carried out in order to measure the in-situ shear wave velocity on the Site for seismic site classification, as well as to attempt to locate/define the extent of the potential mass concrete foundation adjacent to the pivot pier.

The work for this investigation was completed in accordance with SNCL's approved proposal (Ref. No. P16-2676, dated November 11, 2016). Final borehole locations were shifted somewhat from locations proposed, due to proximity of existing buried utility services.

This report contains the findings of SNCL's geotechnical investigation, together with recommendations and comments. These recommendations and comments are based on factual information and are intended only for the use of the design engineers. The recommendations and opinions in this report are applicable only to the proposed project as described in this Section. The Report Limitations are an integral part of this report.

Investigation of environmental aspects of the project was not a part of the scope of this investigation. It is possible that contaminated sources located outside of the subject property boundary may impact groundwater. Detailed environmental study and analysis to address such issues was beyond the scope of this geotechnical study. It is noteworthy that relevant environmental guidelines and regulations may have significant impact on project costs. Environmental guidelines and regulations are subject to change and shall be verified and taken into account when designing and preparing the project.

2 Method of Investigation

2.1 Fieldwork – Drilling Investigation

A Site Location Plan (Figure 1) and Borehole Location Plan (Figure 2) are presented in Appendix 1 of this report.

Five (5) boreholes, identified as BH1 through BH5 were advanced on the Site. All boreholes were advanced to a depth of 9.8 m below existing site grades using 200 mm diameter hollow-stem continuous-flight augers, with a track mounted drill rig (CME-55LC), under the full-time supervision of experienced geotechnical personnel from SNCL.

Soil samples were taken while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg (140 lb.) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inch) outer diameter (O.D.) split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as the SPT 'N' value of the soil which indicated the consistency of cohesive soils or the relative density of non-cohesive soils.

Upon completion of drilling, the soil samples were transported to our soil laboratory for further examination and laboratory testing.

Groundwater observations were made in the boreholes upon completion of drilling. It should be noted that there was not sufficient time available for the groundwater to stabilize inside the open boreholes. In addition, two (2) 37.5 mm diameter PVC standpipe piezometers were installed in boreholes BH2 and BH4 in order to make stabilized static groundwater observations.

2.2 Borehole Location Surveying

SNCL conducted a survey for borehole elevations and coordinates upon completion of the field work. UTM coordinates and ground surface elevations were collected at each borehole location using a Trimble R8 GNSS survey system connected to a VRS network. The coordinates and elevations are presented on borehole logs and are summarized in the following Table:

Table 1: Borehole Locations and Ground Surface Elevations

Borehole ID	Approximate Elevation (m AMSL) ⁽¹⁾	Borehole Easting (UTM Zone 17)	Borehole Northing (UTM Zone 17)
BH1	213.4	714986.8	4910912.3
BH2	213.5	714987.7	4910932.6
BH3	213.6	714993.6	4910914.8
BH4	213.6	715009.9	4910942.6
BH5	213.5	7150616.6	4910921.7

1) m AMSL: m above mean sea level

It should be noted that the above coordinates and elevations are provided to establish relative differences between borehole locations, and should not be used for construction purposes.

2.3 Fieldwork – Geophysical Investigation

A geophysical investigation was carried out in order to measure the in-situ shear wave velocity on the Site for seismic site classification, as well as to attempt to locate/define the extent of the potential mass concrete foundation adjacent to the pivot pier. The shear wave velocity testing was carried out the multi-channel analysis of surface waves (MASW) method, while the subsurface scanning in the vicinity of the pivot pier was carried out using ground penetrating radar. Detailed descriptions of methodology, as well as the results of the geophysical investigation, are described in detail in the attached geophysical investigation report presented in Appendix 4.

3 Subsoil Conditions

The soil descriptions given in this report and the borehole logs are based on current geotechnical practice, as per the Canadian Foundation Engineering Manual, 4th Edition. The various terms describing the soils are given at the beginning of Appendix 2.

Details of the subsurface conditions encountered are presented on the individual borehole logs attached to this report as Appendix 2. It is emphasized however, that the soil types, their sequence, thickness and physical properties may vary between test locations and samples both vertically and horizontally. The encountered subsoil conditions are summarized as follows:

3.1 Topsoil

A surficial covering of clayey topsoil was encountered at all borehole locations. This topsoil was observed to be 0.1 m in thickness at borehole BH1, and 0.2 m in thickness at boreholes BH2 through BH5. It should be noted that it is our experience that topsoil thickness can vary greatly across a Site, between and beyond borehole locations.

3.2 Silty Sand Fill

A light brown silty sand fill with some gravel and some clay was encountered at all borehole locations in the following intervals:

- › BH1 from 0.1 to 3.1 m below ground surface (mbgs);
- › BH2 from 0.2 to 3.1 mbgs;
- › BH3 from 0.9 to 3.8 mbgs;
- › BH4 from 1.8 to 3.5 mbgs; and
- › BH5 from 2.3 to 3.5 mbgs.

The recovered samples of this stratum were visually described to be in a moist condition. Moisture content measurements obtained on the extracted samples were found to be between 4 and 19% by weight

The SPT 'N' values measured within this material were found to be between 4 and 16 blows per 300 mm of penetration, indicating a very loose to compact relative density.

3.3 Silty Clay Fill

A dark brown silty clay fill with some sand and some gravel was observed at boreholes BH3 through BH5, in the following intervals:

- › BH3 from 0.2 to 0.9 mbgs;
- › BH4 from 0.2 to 1.8 mbgs; and
- › BH5 from 0.2 to 2.3 mbgs.

The recovered samples of this stratum were visually described to be in a moist condition. Moisture content measurements obtained on the extracted samples were found to be between 2 and 22%, with the exception of sample identified as BH5/SS1 with a moisture content of 33%.

The SPT 'N' values measured within this material were found to be between 6 and 30 blows per 300 mm of penetration, indicating a consistency ranging from firm to hard.

3.4 Wood Fragments/Sand Fill

A black fill material consisting of wood fragments with varying amounts of sand was encountered at boreholes BH4 and BH5, in the following intervals:

- › BH4 from 3.5 to 3.8 mbgs; and
- › BH5 from 3.5 to 3.8 mbgs.

The recovered samples of this material were visually described to be in a moist condition. Moisture content measurements obtained on the extracted samples were found to be between 25 and 35% by weight.

The SPT 'N' values measured within this material at both locations were found to be 10 blows per 300 mm of penetration, indicating a compact consistency.

3.5 Native Sandy Silt

A light brown native sandy silt with some clay and some gravel was found to underlie the fill soils at all borehole locations, in the following intervals:

- › BH1 from 3.1 to 7.9 mbgs;
- › BH2 from 3.1 to 7.9 mbgs;
- › BH3 from 3.8 to 7.9 mbgs;
- › BH4 from 3.8 to 9.8 mbgs (however possible start of gravelly sand stratum was noted at a depth of 9.1 mbgs, inferred from observation of auger cuttings); and
- › BH5 from 3.8 to 7.6 mbgs.

The recovered samples of this stratum were visually described to be in a moist condition. Moisture content measurements obtained on the extracted samples were found to be between 4 and 14% by weight.

SPT 'N' values measured within this stratum varied between 4 and greater than 55 blows per 300 mm of penetration, indicating a relative density ranging from loose to very dense. Refusal to the sampler was encountered within this material at samples identified as BH3/SS10, BH4/SS8, and BH4/SS11.

3.6 Native Gravelly Sand

A light brown native gravelly sand with some silt and trace clay was encountered at all borehole locations with the exception of borehole BH4 (however it was potentially inferred, as mentioned in Section 3.5 above), in the following intervals:

- › BH1 from 7.9 to 9.8 mbgs (end of borehole);
- › BH2 from 7.9 to 9.8 mbgs (end of borehole);
- › BH3 from 7.9 to 9.8 mbgs (end of borehole); and
- › BH5 from 7.6 to 9.8 mbgs (end of borehole).

The recovered samples of this stratum were visually described to be in a wet condition. Moisture content measurements obtained on the extracted samples were found to be between 3 and 11% by weight.

SPT 'N' values measured within this stratum varied between 18 and greater than 50 blows per 300 mm of penetration, indicating relative density ranging from compact to very dense. Refusal to the sampler was encountered within this material at samples identified as BH1/SS10, BH3/SS10, and BH5/SS11.

4 Laboratory Testing

4.1 Geotechnical Laboratory Testing

All recovered samples were transported back to SNCL’s laboratory located in Kingston, Ontario. Visual soil classifications made in the field were verified by peer review in the lab. Moisture content determinations were completed on all recovered samples.

Grain size analysis and Atterberg limits testing was performed on two (2) select samples identified as BH1/SS5 and BH4/SS7. The results of these tests are presented in the following tables, and are also presented in Appendix 3 of this report.

Table 2: Summary of Gradation Testing Results

Sample ID	Sample Depth	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH1/SS5	3.0-3.7	10	36	39	15
BH4/SS7	4.6-5.2	12	37	36	15

Table 3: Atterberg Limits Testing Results

Sample ID	Sample Depth	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Soil Classification
BH1/SS5	3.0-3.7	15	12	3	ML – Silt
BH4/SS7	4.6-5.2	16	12	4	ML – Silt

5 Groundwater Conditions

Groundwater observations were made in the boreholes as drilling proceeded and upon completion of drilling. It should be noted that there was not sufficient time available for the groundwater to stabilize inside the open boreholes.

In addition two (2) 37.5 mm diameter PVC standpipe piezometers were also installed in boreholes BH2 and BH4, screened within overburden soils, in order to measure stabilized static groundwater levels.

Table 4: Water Level Observations

Borehole ID	Water Level Observed in Open Borehole Upon Completion (mbgs / m AMSL)	Water Level Observed in Installed Piezometer on December 20, 2016 (mbgs / m AMSL)
BH1	6.1 / 207.3	N/A
BH2	6.1 / 207.4	2.4 / 211.1
BH3	6.4 / 207.2	N/A
BH4	7.6 / 206.0	2.6 / 211.0
BH5	6.7 / 206.8	N/A

*N/A - no piezometer installed

Water in the canal in the vicinity of the bridge was noted to be lowered for the winter season, and was at approximately 210.5 m AMSL at the time of the investigation. The sector gates just north of the Site were closed at the time of the investigation.

Groundwater should be expected to fluctuate seasonally and can be expected to be somewhat higher in response to major weather events. It is also expected that the groundwater level of the Site would to a large extent be controlled by the water level of the canal. No long-term groundwater monitoring provisions were made in this investigation program.

6 Discussion and Recommendations

6.1 General

Based on our understanding of the proposed development, it is expected that only the complete reconstruction option would involve the construction of new foundations to support a new bridge structure and abutments. However, there may also be potential for the requirement of new and/or widened foundations to be constructed in the major rehabilitation option, depending on the final design.

Based on the results of the field investigation, in the complete re-construction scenario, new foundations could consist of spread or strip footings constructed on competent native sandy silt soil, or deep foundations not sensitive to the presence of groundwater during their installation (e.g. continuous flight auger piles, helical piers, driven steel piles etc.) can also be considered. However, in the case of the major rehabilitation, where the existing foundations will remain in place, if any new foundations are required they could also be supported on auger cast or helical pier systems, in order to reduce the requirement for deeper excavations and dewatering.

6.2 Site Preparation

If the complete reconstruction option is carried out, all existing foundations should be removed in the footprint of new foundations (i.e. new foundations should not bear on any old foundations). New footings should be constructed on native sandy silt soils, at the minimum elevations described in Section 6.5.1, or deeper, or the new foundations could be supported on deep foundations.

If the major rehabilitation option is carried out and additional foundations are required to be constructed, they can either consist of shallow foundations on native sandy silt at elevations per Section 6.5.1, or supported on deep foundation types as described above, provided this is acceptable from structural engineers' point of view.

It is possible that the silty sand fill soils may be able to be re-used as backfill, provided they are found to be free of deleterious materials and within their optimum moisture content range – further evaluation can be carried out at the time of construction. The contractor should make an effort to separate any deleterious and/or oversize material from the excavated fills if they are contemplated to be used as backfill.

Due to the shallow groundwater table, at an elevation of approximately 211 m AMSL (however this may fluctuate depending on the prevailing water level in the canal), dewatering measures must be implemented prior to excavation. Shoring is also expected to be necessary due to the required deep fill soils. Designers should keep in mind that the existing canal wall foundation (i.e. underpinning) and wall itself (lateral support) may be required to be supported during any bridge replacement works.

6.3 Excavation

6.3.1 Open Cut

Excavations of up to approximately 5.3 mbgs are expected to be required in order to reach a suitable native strata for construction of new spread or strip foundations. Due to the required deep excavations, as well as the shallow nature of the groundwater table with respect to the required depths, a shoring system such as a tightly interlocking sheet pile wall will be necessary, which extends to a sufficient depth to provide cut off of groundwater infiltration and provides full stability of the working base of the excavation.

If tightly interlocking sheeting is used, dewatering can be effected by pumping from filtered sumps within the sheeting enclosure, but the sheeting must be driven into an impervious stratum, or a significant distance below the bottom of the excavation in cases where an impervious stratum is not present. Sufficient distance would normally be equal to the height of water above the bottom of the trench, plus about 0.6 m. In some instances however, the stability of the sheeting may require deeper penetration – this should be checked by shoring designers. The portion of the sheeting below any new foundations may have to be left in place in order to prevent disturbance of the soil below the foundation when the sheeting is withdrawn.

Shoring systems must be designed by a professional engineer licensed in the province of Ontario, in accordance with relevant codes, standards and regulations such as the latest version of Canadian Engineering Foundation Manual and the OHSa Regulations for Construction Projects. The shoring system should be designed to resist full earth and groundwater pressures, as well as the surcharge due to construction and traffic loadings. The following parameters may be used to assist designers of shoring systems:

Table 5: Lateral Earth Pressure Parameters

Soil Type	Bulk Unit Weight, γ (kN/m ³)	Angle of Internal Friction (Φ)	Coefficient of Lateral Earth Pressure		
			K_a	K_o	K_p
Silty Sand Fill	20.0	29	0.34	0.51	2.88
Silty Clay Fill	81.0	24	0.42	0.59	2.30
Wood Fragments/Sand Fill	16.0	24	0.42	0.59	2.30
Native Sandy Silt	20.5	31	0.32	0.48	3.12
Native Gravelly Sand	21.0	33	0.29	0.45	3.39
Compacted Granular 'A'	21.0	34	0.28	0.44	3.55
Compacted Granular 'B' Type II	21.5	35	0.27	0.43	3.70

All excavations must be carried out in accordance with the OHSa regulations for Construction Projects, which states that if workmen must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced. OHSa specifies maximum slopes of excavations for four broad soil types as summarized in the following table:

Table 6: Maximum Slope of Excavation for Soil Type

Soil Type	Base of Slope	Maximum Slope Inclination
Type 1	Within 1.2 metre of bottom of trench	1 horizontal to 1 vertical
Type 2	Within 1.2 metre of bottom of trench	1 horizontal to 1 vertical
Type 3	From bottom of excavation	1 horizontal to 1 vertical
Type 4	From bottom of excavation	3 horizontal to 1 vertical

Fill at this Site above the groundwater can generally be classified as Type 3 soils. Competent native soils at this Site can be classified as Type 2 to Type 3 soils, but generally Type 3. However, any soils affected by groundwater seepage must be considered as Type 4 soils. The highest number soil type identified in an excavation must govern the excavation slopes from top to bottom of the excavation.

If the above recommended excavation side slopes cannot be maintained due to lack of space or any other reason, the excavation sides must be supported by an engineered shoring system. The shoring system should be designed in accordance with relevant codes, standards and regulations such as the latest version of Canadian Engineering Foundation Manual and the OHS Regulations for Construction Projects.

For all cut slopes, the stability of the cut slopes will have to be frequently monitored by the geotechnical engineer. If the cut slopes are subject to erosion (e.g., due to rainfall, high groundwater flow, etc.), slope stabilization measures (e.g., covering the slope/trench faces with plastic sheets, excavating flatter slope, etc.) will have to be implemented.

Stockpiles of excavated materials should be kept at least 3 m from the edge of the excavation to prevent slope instability, subject to confirmation by the geotechnical engineer. Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

Allowance should be made for boulders and cobbles or other obstacles that may be found within the soil strata. Contractors should be aware of the dense nature of the fill soils at this Site, in addition to the possible presence of debris and refuse contained within, and select equipment/make allowances appropriately.

6.4 Dewatering

As mentioned in Section 5, the stabilized groundwater level as measured in the installed monitoring wells subsequent to the completion of the investigation was between 2.4 and 2.6 mbgs (approximate elevation of 211 m AMSL). Based on the relatively shallow static groundwater elevations which were observed during this investigation and potentially deep excavations required, active dewatering is going to be required for excavations on this project in areas where groundwater cannot be cut off through the use of tightly interlocking sheeting. Any form of dewatering must consider possible settlements that may be caused on the adjacent areas, including the possible adverse effects on the existing and nearby structures, roads, underground services etc. It should also consider the large body of water present (e.g. the Canal) as well as the relatively high permeability of the soils encountered in the boreholes. For

these reasons, dewatering may be impractical. A specialist dewatering contractor should be consulted in order to determine the most appropriate dewatering methodology, however the following general guidance is provided for designers of a dewatering system for this Site:

- › Standby pumping capacity should be provided, in addition to an adequate primary capacity;
- › Effective filters must be utilized in order to prevent migration of soil fines and ground loss;
- › Pumped water must be discharged such that it will not interfere with excavations;
- › Groundwater must be maintained at least 0.5 m below the base of any open excavations, including any progressively rising backfill during its placement in order to prevent ‘pumping’ of the base due to construction traffic/compaction efforts;
- › Adequate monitoring of groundwater levels must be carried out – this may involve installation of further monitoring wells prior to construction; and
- › On completion of construction activities, dewatering systems should be gradually shut down to prevent the creation of transient critical exit gradient conditions, which may result in migration of fines.

It should be noted that if pumping volumes for construction dewatering are less than 400,000L per day, a Permit to Take Water (PTTW) from the Ontario Ministry of the Environment (MOE) is no longer required. However, registration under the Environmental Activity and Sector Registry (EASR) from the MOE will be required.

6.5 Foundations

6.5.1 Shallow Foundations

The following table summarizes the recommended bearing elevations for shallow foundations constructed on undisturbed native sandy silt soils:

Table 7: Recommended bearing Elevations – Shallow Foundations

Borehole ID	Competent Native Subgrade – 150 kPa SLS, 225 kPa ULS (mbgs / m AMSL)
BH1	3.2 / 210.3
BH2	3.2 / 210.4
BH3	4.6 / 209.0
BH4	4.6 / 209.0
BH5	5.3 / 208.2

Any foundation elements from the existing structures which are encountered are not recommended to be re-used, and should be removed prior to placement of new foundations.

Footings should be constructed such that they do not exceed a slope of 2 horizontal in 1 vertical over their length.

Excavations for sump pits, utility trenches or similar should not intersect a zone which would extend downward at an angle of 1 horizontal to 1 vertical, 0.3 m away from the bottom outside edges of new or existing (i.e. canal wall) foundations without provision of proper support.

6.5.2 Deep Foundations

6.5.2.1 CFA Piles

Continuous Flight Auger Piles (CFA), also known as Auger Press Piles, are a type of drilled foundation in which the pile is drilled to the final depth in one continuous process, using continuous flight augers. As the auger is withdrawn from the hole, concrete or a sand/cement grout is placed by pumping the concrete/grout mix through the hollow center of the auger pipe to the base of the auger. Simultaneous pumping of the grout or concrete and withdrawing of the auger provides continuous support to the hole. Where required, steel reinforcement is placed into the hole filled with fluid concrete/grout immediately after the withdrawal of the auger. CFA piles are typically constructed in diameters ranging from 0.3 to 0.9 m. The CFA pile length with the prevailing surface and subsurface conditions at the site need to be discussed with a specialist contractor.

CFA piles can be constructed as single piles (similar to drilled shafts), for example, for noise wall or light standard (pole) foundations. For larger structural foundations, CFA piles are commonly installed as part of a pile group in a manner similar to that of driven pile foundations. Similar to driven piles, the top of a group of CFA piles is terminated with a cap. Typical minimum center-to-center spacing is 4 to 5 diameters but preferably not less than 5.

CFA piles differ from conventional drilled shafts or bored piles, and exhibit both advantages and disadvantages over conventional drilled shafts. The main difference is that the use of casing or slurry to temporarily support the piles is avoided. Drilling the hole in one continuous process is faster than drilling a shaft excavation, an operation that requires the drill bit multiple times to complete the excavation. In contrast, the torque requirement to install the continuous auger is high compared with a conventional drilled shaft of similar diameter; therefore, the diameter and the length of CFA piles are generally less than drilled shafts, as well as limiting the depths. Because CFA pile are drilled and cast-in-place rather than being driven, as in driven piles, noise and vibration due to installation are reduced. CFA piles also eliminate splices and cut-offs. Soil heave due to driving can be eliminated when non-displacement CFA piles are used. Hydrostatic uplift conditions at the bottom can be counter-balanced with concrete or a sand/cement grout.

Depending on the diameter and depth of the CFA pile, resistance values of up to the order of about 1100 kN/pile (factored) at ULS and 800 kN/pile at SLS would likely be available, however this would have to be discussed with a specialist contractor.

6.5.2.2 Helical Pier Foundations

Helical piles are a factory-manufactured steel foundation system, consisting of a central shaft with one or more helix-shaped bearing plates and a bracket that allows attachment to a structure. The helix plates are commonly referred to as blades or flights and are welded to the

lead section. Extension shafts, with or without additional helix plates, are used to extend the pile to competent load bearing soil and to achieve design depths and capacity. Brackets are used at the tops of the piles for attachment to structures, either for new construction or for retrofit applications. The pile is augered into the soil until it is advanced to a stratum competent enough to carry the design loads. The capacity of the pile is confirmed using the measured torque required to advance the pile.

A perceived disadvantage is relatively low load carrying capacity per pile (typically 250 to 350 kN/pile at SLS, and up to 500 kN/pile at ULS for axial compression, depending on the type and model used).

Due to the specialized and often proprietary nature of helical pile systems, a specialist deep foundations contractor would have to be consulted in order to provide approximate axial and uplift capacities, as well as the suitability of the pile system for the prevailing subsurface conditions.

6.5.2.3 Driven Steel Piles

Driven steel tube or H-piles could be alternative types of foundations to consider. Such piles are typically driven to end bearing into a competent stratum, below the depths explored in this investigation. These end bearing piles will generate vibrations during their installation, which may be objectionable.

In this case, to reduce vibrations, relatively low geotechnical resistances are suggested for preliminary design, as follows:

- › SLS – 600-700 kN/pile
- › ULS – 900-1000 kN/pile

We will be pleased to further discuss the use of deep foundations for this project. Deeper boreholes will be required for driven piles, and possibly also for other types of deep foundations, which were discussed. If deeper boreholes reveal the presence of bedrock at relatively shallow depths, the use of steel micro-pile foundations may also offer an alternate solution.

6.5.3 Design for Earthquakes

Building foundations are required to be structurally designed to resist a minimum earthquake force, as defined in the National Building Code of Canada, 2010 (NBCC) and Ontario Building Code, 2012 (OBC).

SNCL retained a qualified geophysics subconsultant (Geophysics GPR International Ltd.) in order to carry out an in-situ shear wave velocity sounding on the Site. The sounding was carried out using the multi-channel analysis of surface waves (MASW) method. Based on the results of the geophysical testing, the average shear wave velocity between 0 and 30 mbgs was found to be 836 m/s. Therefore, this Site could be considered as Site Class 'C' (overburden thickness would not permit the use of Site Class 'B' at this Site).

The full report by Geophysics GPR International Ltd. can be found presented in Appendix 4 of this report.

6.5.4 Frost Protection

A permanent soil cover of 1.6 m or an equivalent in thermal insulation is required for frost protection of all foundations in the Peterborough area.

If thermal insulation is being considered, appropriate products and placement instructions are best obtained from individual manufacturers. It is important to consider that some products may be required to be placed directly on the subgrade surface prior to placement of concrete.

6.6 Engineered Fill

Engineered Fill application may be required on this project in order to raise subgrade elevations.

For any fill operation to be considered Engineered Fill, the following criteria must be satisfied:

- › Engineered Fill should consist of a uniform, homogeneous material. The fill material should also be free of organics, deleterious materials (i.e. building debris such as bricks, metal etc.). Materials meeting Ontario Provincial Standard Specifications (OPSS) Granular 'B' Type I or II specifications would be considered as a suitable Engineered Fill material;
- › Prior to the placement of Engineered Fill, it must be evaluated for suitability in the Geotechnical Laboratory. Samples should be provided to the Geotechnical Engineer and submitted for Standard Proctor and grain size analysis;
- › Engineered Fill must be compactable, and of a suitable moisture content such that it is within +/- 2.0% of its optimum moisture content, as determined through laboratory testing;
- › Engineered Fill must be placed under the continuous supervision of a Geotechnical Engineer or their designate;
- › Each layer of material should be placed in maximum 0.2 m lifts, and uniformly compacted with heavy compaction equipment suitable for the type of fill used, to 100% of the material's Standard Proctor Maximum Dry Density (SPMDD);
- › Field density tests must be taken on each lift of Engineered Fill. Any Engineered Fill which is tested and found to be out of specification shall either be removed, reworked or retested; and
- › Engineered Fill placed underneath foundations must extend laterally a minimum of 0.5 m from the outside edge of footings, and extend downward at an angle of 1 horizontal to 1 vertical to the base of the excavation.

7 Closure

The recommendations provided in this report are based on subsoil data obtained at the sounding locations. Experience indicates that the subsoil and groundwater conditions can vary significantly between and beyond the sounding locations. For this reason, the recommendations given in this report are subject to a field verification of the subsoil conditions at the time of construction.

Should any site condition encountered differ from those at the tested locations or any changes in the project, we request that SNCL be notified immediately in order to permit reassessment of the recommendations.

8 General Conditions and Limitations

A. Use of the Report

- A.1 The work performed in this report was carried out in accordance with the terms and conditions made part of our proposal and/or contract pursuant to which the report was issued. The conclusions presented in the report are based solely upon the scope of services, governed by the time and budgetary considerations to which this work is subject.
- A.2 The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation or if the project is not initiated within twelve months of the date of the report, SNC should be given an opportunity to confirm that the recommendations are still valid.
- A.3 The comments given in this report are intended only for the guidance of the design engineer. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual test hole data, as to how subsurface conditions may affect their work.
- A.4 The reader should be advised that geotechnical opinions, presented in this report, are subject to inherent uncertainties due to sampling limitations.
- A.5 The report must be read as a whole, as sections taken out of context may be misleading. Drafts and working copies of study reports and other deliverables, whether or not marked "draft" and/or "for discussion purposes", do not necessarily reflect SNCL's final opinion following consideration of all matters which are the subject of the study giving rise thereto; they are issued for comment and information purposes only, and are subject to change. The reader should not rely on such documents for any purpose.

B. Follow-up

- B.1 All details of the design and proposed construction may not be known at the time of submission of *SNCL's* report. It is recommended that *SNCL* be retained during the final design stage to review the design drawings and specifications related to foundations, earthworks, retaining systems and drainage, to determine that they are consistent with the intent of *SNCL's* report.
- B.2 Retention of *SNC* during construction is recommended to confirm and document that the subsurface conditions throughout the site do not materially differ from those given in *SNCL's* report and to confirm and document that construction activities did not adversely affect the design intent of *SNCL's* recommendations.

C. Soil and Rock Conditions

- C.1 Soils and/or rock descriptions in this report are based on commonly accepted methods of classification and identification employed in professional geotechnical practice. Classification and identification of soil and rock involves judgment and

SNCL does not guarantee descriptions as exact, but infers accuracy only to the extent that is common in current geotechnical practice.

- C.2 The soils and rock conditions described in this report are those observed at the time of the study. Unless otherwise noted, those conditions form the basis of the recommendations in the report. The condition of the soil and rock may be significantly altered by construction activities (traffic, excavation, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting or drying. Unless otherwise indicated the soil and rock must be protected from these changes or disturbances during construction.

D. Logs of Test Holes and Subsurface Interpretations

- D.1 The test hole logs indicate the approximate subsurface stratigraphy and conditions only at the locations of the test holes. Soil and rock formations are variable to a greater or lesser extent. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface stratigraphy and conditions are indicated depends on the method of boring, the frequency of sampling, the method of sampling and the uniformity of subsurface stratigraphy and conditions.
- D.2 Subsurface stratigraphy and conditions between test holes are inferred and may vary significantly from stratigraphy and conditions encountered at the test holes.
- D.3 Groundwater elevations and conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary seasonally or as a consequence of construction activities on the site or adjacent sites.

E. Changed Conditions

- E.1 Where conditions encountered at the site differ significantly from those described or anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the use or reliance by the client on this report that *SNCL* is notified of the changes and provided with an opportunity to review the recommendations of this report. Recognition of changed soil and rock conditions requires experience and it is recommended that an experienced geotechnical engineer be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

F. Drainage

- F.1 Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage can have serious consequences. *SNCL* can take no responsibility for the effects of drainage unless *SNCL* is specifically involved in the detailed design and follow-up site services during construction of the system.

END OF DOCUMENT

Appendix 1

Borehole Location Plan and Site Location Plan




LEGEND

 AS PAVED SURFACE

NOTES

1. A
2. Dr

NO	DESCRIPTION	DATE

 **SNC-LAWALIN**
 CLIENT: SNC L
 PROJECT: R Rd S Rd
 LOCATION: P Rd E P
 TITLE: S L P
 SCALE: NTS
 DATE: 2017
 FILE: 1-2150-2
 DIV: 00
 DRAWING: 1

Appendix 2

Record of Boreholes



NOTES TO RECORD OF BOREHOLES

DRILLING DATA

Method:	-	
SolSt Auguring	-	Solid Stem Auguring
HolSt Auguring	-	Hollow Stem Auguring
WB	-	Washed Boring

LABORATORY DATA

W_P	-	Plastic Limit
W	-	Water Content (%)
W_L	-	Liquid Limit
γ	-	Natural Unit Weight (kN/m^3)
UNDR STRNG or c_u	-	Undrained Shear Strength (kPa) Field Vane: St-sensitivity
pp	-	Pocket Penetrometer
UC	-	Unconfined Compression
UU	-	Unconsolidated Undrained at Overburden Pressure
CU	-	Consolidated Undrained
CD	-	Consolidated Drained
TOV	-	Total Organic Vapors

SAMPLES TYPE

SS	-	Split Spoon
AS	-	Auger Sample
TW	-	Thin wall Open
TP	-	Thin wall Piston
WS	-	Washed Sample
BS	-	Block Sample
RC	-	Rock Core
PH	-	Sample Advanced Hydraulically
PM	-	Sample Advanced Manually

Standard Penetration Test: The Standard Penetration Test (SPT) 'N'-values are the number of blows required to cause a standard 51 millimeters o.d. split barrel sampler to penetrate 0.3 meter into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kilograms falling freely a distance of a 0.76 meter. For penetrations of less than 0.3 meter, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeters penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimeters o.d. 60° cone angle) driven by 475 J impact energy on a size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3 meter advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or relative density

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (c_u) or 'N'-values as follows:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
N (blows/0.3 meter)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30

COMPACTNESS CONDITION: Cohesionless soils are described on the basis of compactness condition as indicated by 'N'-values as follows:

N (blows/0.3 meters)	0 - 4	4 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

Rocks are described by their composition and structural features and/or strength

RECOVERY: Sum of all recovered rock core pieces from a coring run expressed as a percent of the total length of the coring run.

ROCK QUALITY DESIGNATION (RQD): Sum of those intact core pieces, 100 millimeters in length expressed as a percent of the length of the coring run. Classification of a rock based on the RQD value as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50 mm	50 - 300 mm	0.3 - 1.0 m	1.0 - 3.0 m	>3.0 m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

RECORD OF BOREHOLE No. BH1

Project Number: 16-2150-29 Drilling Location: South of west abutment Logged by: MM
 Project Client: SNC-Lavalin Transportation Drilling Method: 200 mm Hollow Stem Augers Compiled by: MM
 Project Name: Warsaw Swing Bridge Rehabilitation Drilling Machine: Track Mounted CME-55LC Reviewed by: DH
 Project Location: Park Hill Road East, Peterborough, ON Date Started: Dec 8, 16 Date Completed: Dec 8, 16 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Penetration Testing ○ SPT ● DCPT			MTO Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould	★ Rinse pH Values 2 4 6 8 10 12	Soil Vapour Reading parts per million (ppm) 100 200 300 400	Lower Explosive Limit (LEL) W _p W _l W _u		
	Local Ground Surface Elevation: 213.4 m													
	black topsoil - silty clay laden with rootlets	SS	1	41	14		213	○			○15			
	light brown fill - silty sand, some gravel, some clay compact moist	SS	2	51	12		212	○			○10			
		SS	3	51	12		211	○			○5			
		SS	4	75	10		210	○			○13			
	light brown SANDY SILT- some clay, some gravel compact moist G: 10% SA: 36% SI: 39% CL: 15% (ML)	SS	5	67	13		210	○			●10			
		SS	6	70	16		209	○			○9			
		SS	7	92	20		208	○			○10			
							207	○			○11			
							206				○11			
	light brown GRAVELLY SAND- some silt, trace clay dense wet	SS	9	75	35		205	○			○9			
		SS	10	38	R		204				○7			
	end of borehole													
	Note: 1. Coordinates: 4910912.3 N 714986.8 E 2. G, SA, SI, CL and R denotes gravel, sand, silt, clay and refusal to sampler, respectively.													

∇ Groundwater depth on completion of drilling: 6.1 m

RECORD OF BOREHOLE No. BH2

Project Number: 16-2150-29 Drilling Location: North of pivot pier Logged by: MM
 Project Client: SNC-Lavalin Transportation Drilling Method: 200 mm Hollow Stem Augers Compiled by: MM
 Project Name: Warsaw Swing Bridge Rehabilitation Drilling Machine: Track Mounted CME-55LC Reviewed by: DH
 Project Location: Park Hill Road East, Peterborough, ON Date Started: Dec 8, 16 Date Completed: Dec 8, 16 Revision No.: _____

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value						
	Local Ground Surface Elevation: 213.5 m										
	black topsoil - silty clay laden with rootlets	SS	1	59	10	213	○	○10			
	light brown fill - silty sand, some gravel, some clay compact to loose moist	SS	2	51	10	212	○	○9			
		SS	3	51	10	211	○	○11			
		SS	4	75	6	211	○	○10			- bentonite seal
	light brown SANDY SILT- some clay, some gravel compact to dense moist	SS	5	92	11	210	○	○10			
		SS	6	67	14	209	○	○12			- filter sand, 37.5 mm PVC riser
		SS	7	100	15	208	○	○10			
		SS	8	84	31	207	○	○6			- filter sand, 37.5 mm PVC slotted well screen
		SS	9	75	18	206	○	○6			
	light brown GRAVELLY SAND- some silt, trace clay compact to dense wet	SS	10	0	47	204	○	○3			
	end of borehole					203.8					



SNC-LAVALIN
 1164 Clyde Court
 Kingston, ON K7P 2E4
 Tel: 613-389-1781
 Fax: 613-389-4204

▽ Groundwater depth on completion of drilling: 6.1 m.
 ▽ Groundwater depth observed on December 20, 2016 at a depth of: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

RECORD OF BOREHOLE No. BH3

Project Number: 16-2150-29 Drilling Location: South of pivot pier Logged by: MM
 Project Client: SNC-Lavalin Transportation Drilling Method: 200 mm Hollow Stem Augers Compiled by: MM
 Project Name: Warsaw Swing Bridge Rehabilitation Drilling Machine: Track Mounted CME-55LC Reviewed by: DH
 Project Location: Park Hill Road East, Peterborough, ON Date Started: Dec 8, 16 Date Completed: Dec 8, 16 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80			★ Rinse pH Values 2 4 6 8 10 12 Soil Vapour Reading parts per million (ppm) 100 200 300 400 Lower Explosive Limit (LEL) W _p W _L Plastic Liquid 20 40 60 80					
	Local Ground Surface Elevation: 213.6 m													
	black topsoil - silty clay laden with rootlets	SS	1	33	6		213.4				22			
	dark brown fill - silty clay, some sand, some gravel						213.0				16			
	firm moist						212.7				9			
	light brown fill - silty sand, some gravel, some clay	SS	2	33	4	1	212.7							
	very loose to compact moist						212.0				17			
		SS	3	25	4	2	211.7							
		SS	4	75	5	3	211.0				19			
		SS	5	8	11	4	210.3				8			
	light brown SANDY SILT- some clay, some gravel	SS	6	51	7	4	209.8				10			
	loose to dense moist						209.5							
		SS	7	59	15	5	209.0				8			
		SS	8	67	30	6	208.3				7			
		SS	9	70	22	7	207.6				8			
							207.0							
		SS	10	81	R	8	205.8				7			
	light brown GRAVELLY SAND- some silt, trace clay						205.5							
	dense wet						205.0							
		SS	11	59	42	9	203.9				8			
	end of borehole						203.9							
	Note: 1. Coordinates: 4910914.8 N 714993.6 E 2. R. denotes refusal to sampler.						203.9							

∇ Groundwater depth on completion of drilling: 6.4 m.

RECORD OF BOREHOLE No. BH4

Project Number: 16-2150-29 Drilling Location: North of east abutment Logged by: MM
 Project Client: SNC-Lavalin Transportation Drilling Method: 200 mm Hollow Stem Augers Compiled by: MM
 Project Name: Warsaw Swing Bridge Rehabilitation Drilling Machine: Track Mounted CME-55LC Reviewed by: DH
 Project Location: Park Hill Road East, Peterborough, ON Date Started: Dec 7, 16 Date Completed: Dec 7, 16 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING			INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	DEPTH (m)	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Penetration Testing ○ SPT ● DCPT △ Intact ◇ Intact ▲ Remould ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W _p W _L Plastic Liquid 20 40 60 80				
	Local Ground Surface Elevation: 213.6 m												
	black topsoil - silty clay laden with rootlets dark brown fill - silty clay, some sand, some gravel very stiff to stiff moist	213.5 0.7	213	SS	1	67	18	○	○11				
			212	SS	2	75	19	○	○9				
	light brown fill - silty sand, some gravel, some clay loose to compact moist	211.8 1.8	212	SS	3	75	9	○	○10				
			211	SS	4	41	9	○	○12				
			210	SS	5	84	10	○	○7				
	black fill - sand, trace wood fragments compact moist	210.1 3.5 209.8 3.8	210	SS	6	84	6	○	○4				- bentonite seal
	light brown SANDY SILT- some clay, some gravel compact to very dense moist G: 12% SA: 37% SI: 36% CL: 15% (ML)		209	SS	7	70	15	○	●12				
			208	SS	8	100	R		○7				
			207	SS	9	51	54	○	○8				
			206	SS	10	59	55	○	○5				- filter sand, 37.5 mm PVC riser
			205										- filter sand, 37.5 mm PVC slotted well screen
	- possible start of gravelly sand stratum, inferred from observation of auger cuttings	204.5 0.1	204	SS	11	0	R						
	end of borehole	203.9 9.8											



SNC-LAVALIN
 1164 Clyde Court
 Kingston, ON K7P 2E4
 Tel: 613-389-1781
 Fax: 613-389-4204

▽ Groundwater depth on completion of drilling: 7.6 m.
 ▼ Groundwater depth observed on December 20, 2016 at a depth of: 2.6 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 63
 Page: 1 of 1

RECORD OF BOREHOLE No. BH5

Project Number: 16-2150-29 Drilling Location: South of east abutment Logged by: MM
 Project Client: SNC-Lavalin Transportation Drilling Method: 200 mm Hollow Stem Augers Compiled by: MM
 Project Name: Warsaw Swing Bridge Rehabilitation Drilling Machine: Track Mounted CME-55LC Reviewed by: DH
 Project Location: Park Hill Road East, Peterborough, ON Date Started: Dec 8, 16 Date Completed: Dec 8, 16 Revision No.: _____

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	Penetration Testing			MTO Vane*	Nilcon Vane*	★ Rinse pH Values	Soil Vapour Reading		
	Local Ground Surface Elevation: 213.5 m													
	black topsoil - silty clay laden with rootlets	SS	1	62	16		213				33			
	dark brown fill - silty clay, some sand, some gravel very stiff to hard moist	SS	2	41	18	1	212				2			
		SS	3	41	30	2	211				3			
	light brown fill - silty sand, some gravel, some clay compact moist	SS	4	25	16	3	210				4			
		SS	5	33	10	4	209				9			
	black fill - wood fragments, trace to some sand compact moist	SS	6	84	4	4	208				10			
	light brown SANDY SILT- some clay, some gravel loose to dense moist	SS	7	84	7	5	207				14			
		SS	8	59	35	6	206				8			
		SS	9	67	29	7	205				9			
	light brown GRAVELLY SAND- some silt, trace clay very dense wet	SS	10	59	59	8	204				8			
		SS	11	53	R	9	203.8				11			
	end of borehole						203.8							
	Note: 1. Coordinates: 4910921.7 N 715016.6 E 2. R. denotes refusal to sampler.													

▽ Groundwater depth on completion of drilling: 6.7 m.

Appendix 3

Geotechnical Laboratory Results



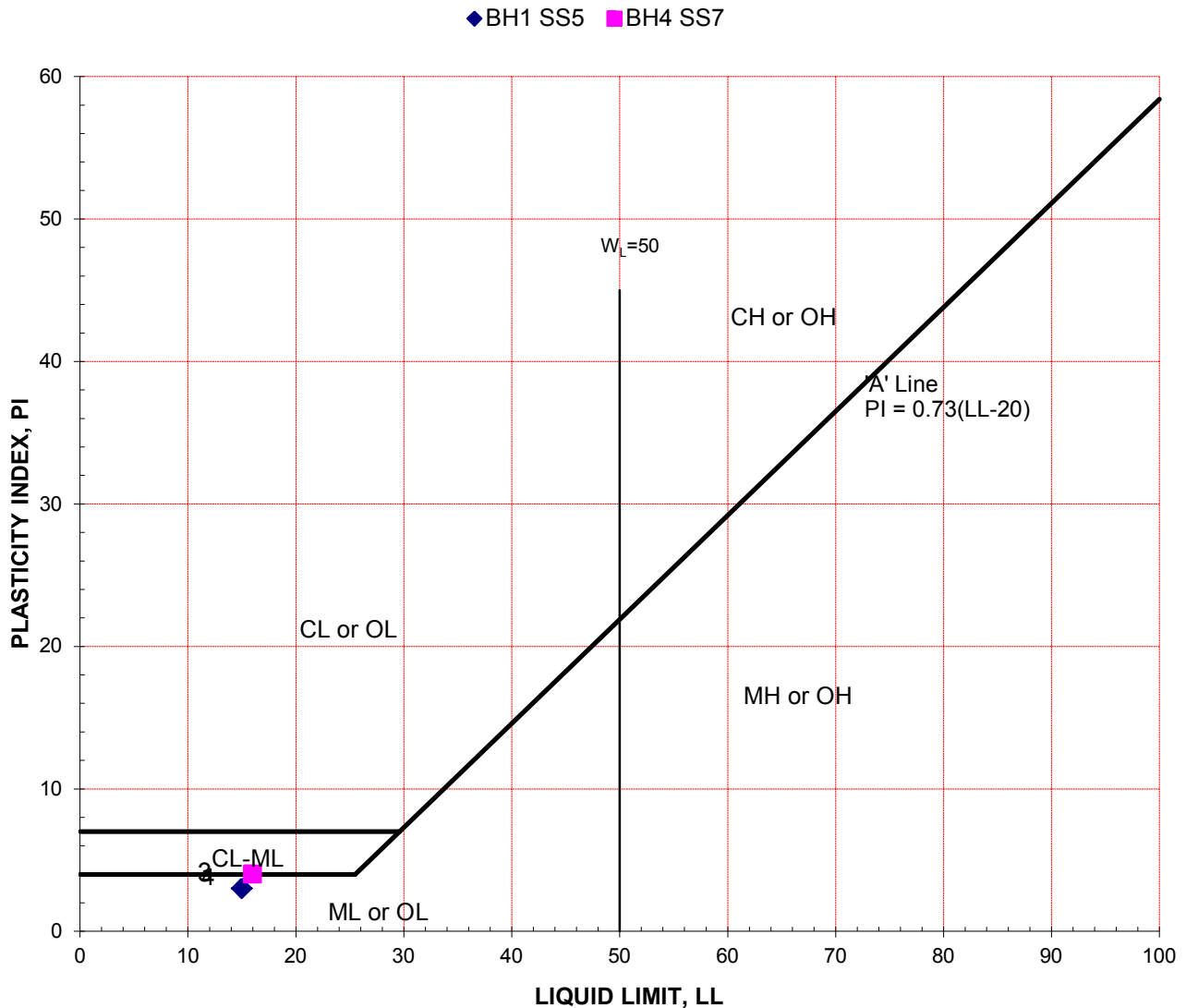
SNC • LAVALIN

PLASTICITY CHART

Job #	: 16-2150-29	Technician	: CO
Project Client	: SNC-Lavalin Transportation	Supervisor	: JU
Project	: Warsaw Road Swing Bridge Rehabilitation	Date	: 12/15/16
Location	: Park Hill Road East, Peterborough, Ontario		

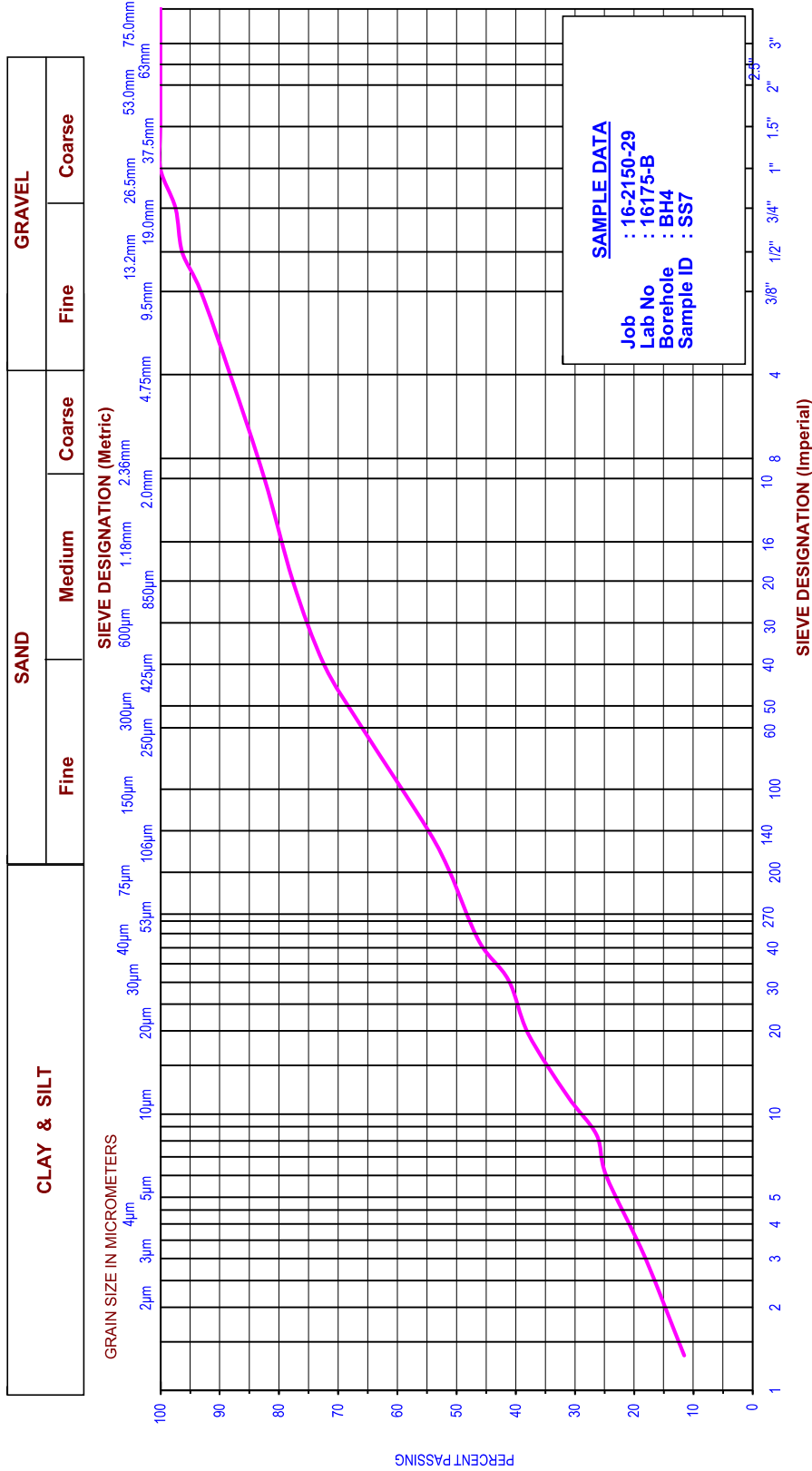
TEST RESULTS

Specimen #	Sample #	Depth	LL%	PL%	PI	Fines	W%	Classification	Remarks
BH1	SS5	3.0-3.7	15	12	3		10	ML	
BH4	SS7	4.6-5.2	16	12	4		12	ML	





UNIFIED SOIL CLASSIFICATION SYSTEM



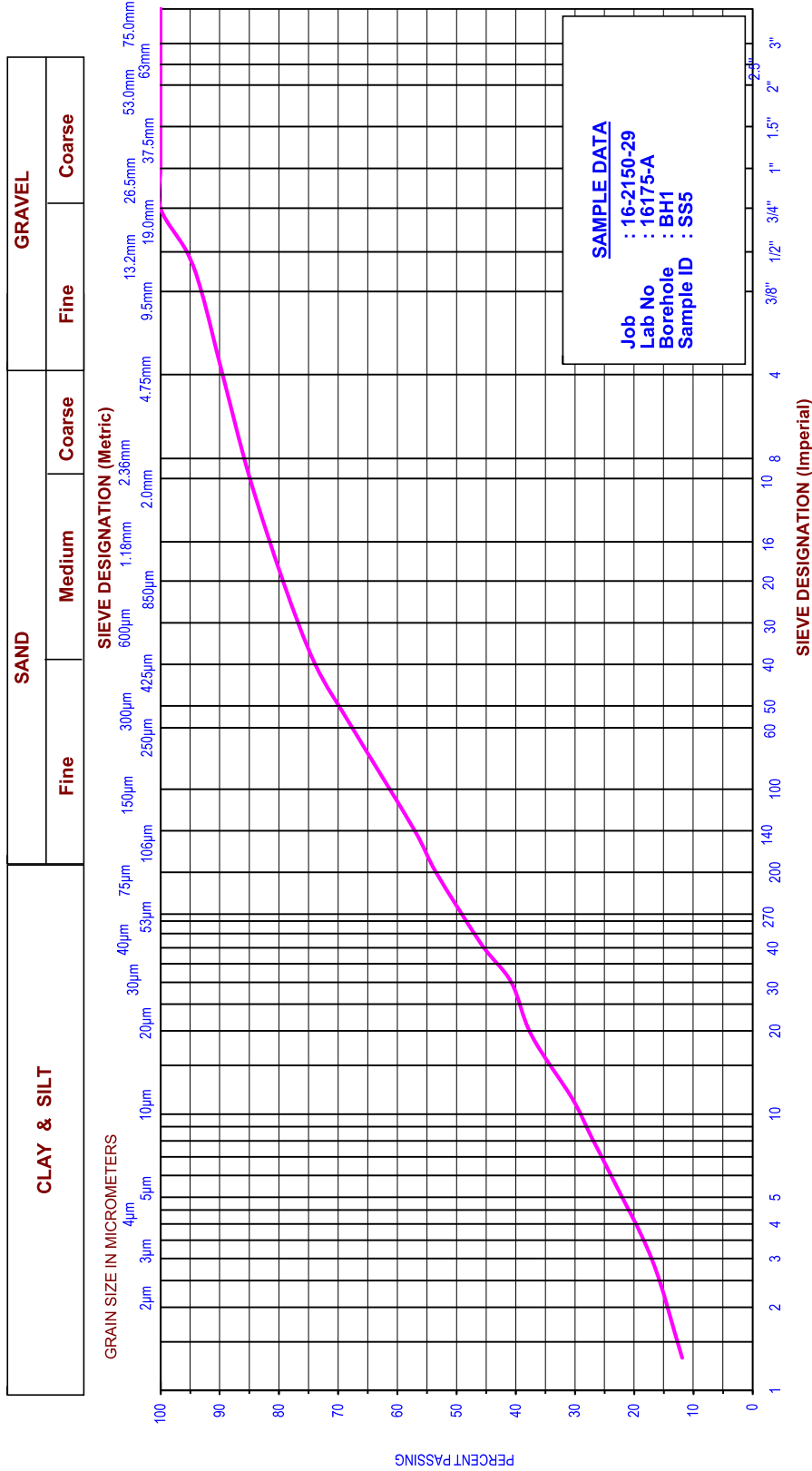
SAMPLE DATA
 Job : 16-2150-29
 Lab No : 16175-B
 Borehole : BH4
 Sample ID : SS7

CLAY & SILT		SAND			GRAVEL	
		Fine	Medium	Coarse	Fine	Coarse
GRAIN SIZE DISTRIBUTION		SILT AND SAND some clay, some gravel				
SNC-LAVALIN 1164 Clyde Court Kingston, Ontario K7P 2E4		Client: SNC-Lavalin Transportation Project: Warsaw Road Swing Bridge Location: Peterborough, Ontario Date: December 15, 2016				

% +3"	% Gravel		% Sand			% Fines	
	Course	Fine	Coarse	Medium	Fine	Silt	Clay
	3	9	6	10	21	36	15



UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Course	Fine	Course	Medium	Fine	Silt	Clay
	0	10	5	11	20	39	15

GRAIN SIZE DISTRIBUTION	
SILT AND SAND	
some clay, some gravel	

Client: SNC-Lavalin Transportation
Project: Warsaw Road Swing Bridge
Location: Peterborough, Ontario
Date: December 15, 2016

SNC-LAVALIN
1164 Clyde Court
Kingston, Ontario K7P 2E4

Appendix 4

Geophysical Investigation Report



GEOPHYSICS GPR INTERNATIONAL INC.

6741 Columbus Road
Unit 14
Mississauga, Ontario
Canada L5T 2G9

Tel.: (905) 696-0656
Fax: (905) 696-0570
gprtor@gprtor.com
www.geophysicgpr.com

December 7, 2016

GPR file: T16883G

Dylan Hill, P.Eng.
Project Manager
SNC-Lavalin
1164 Clyde Court
Kingston, ON
K7P 2E4

RE: Shear-wave velocity sounding and scan around the base of the existing foundation at Warsaw Swing Bridge, Parkhill Road East, Peterborough, Ontario

Dear Mr. Hill:

Geophysics GPR International Inc. has been requested by SNC-Lavalin to carry out a shear-wave velocity sounding at the above site in Peterborough. Figure 1 shows the location of the test profile.

In addition, a ground penetrating radar scan was performed around the visible base of the swing bridge for the purpose of mapping a possible non-visible extended base around the existing visible base. There was available a 270 MHz antenna with a GSSI SIR3000 ground radar system.

The scan could only be performed off to the sides of the bridge (north and south sides) but not under the bridge (east and west sides) because the antennas could not fit under the space.

The results are very difficult to interpret. There seems to be roughly another foundation only 50 to 70 cm deep and 1.3 meters square excavation outside the round foundation. It is not clear if this is concrete or just an extended excavation of granular fill created for the purpose of building the round foundation. See Figure 2 for results.

The survey was performed on November 28th, 2016.

The seismic investigation included both the multi-channel analysis of surface waves (MASW), the micro-tremor array measurements (MAM) and the refraction methods to generate a shear-wave velocity model (Figure 4).

The following paragraphs describe the survey design, the principles of the test method,



the methodology for interpreting the data, and provide a culmination of the results in table format.



Figure 1: Approximate location of the shear-wave velocity sounding



Figure 2: very rough position of the round foundation and extents of a possible outer foundation.



MASW and MAM Surveys

Basic Theory

The Multi-channel Analysis of Surface Waves (MASW) and the Micro-tremor Array Measurements (MAM) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves (“ground roll”). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave (V_s) velocity depth profile (sounding). Figure 3 outlines the basic operating procedure for the MASW method. Figure 4 is an example image of a typical MASW record and resulting 1D V_s model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves*, Park, C.B., Miller, R.D. and Xia, J. *Geophysics*, Vol. 64, No. 3 (May-June 1999); P. 800–808.

Survey Design

The geometry of an MASW survey is similar to that of a seismic refraction investigation (i.e. 24 geophones in a linear array). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an “active source” method. An elastic-wave hammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 25 to 30 m off both ends, and in the middle of the spread. Data were collected with geophones spacing of 3m and 1m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a “passive source” method in that there is no time break and the motions recorded are from ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background “noise.” The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results



for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

Interpretation Method and Accuracy of Results

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package. In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

The results of the MASW/MAM tests are presented in chart format as Figure 4. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The V_{s30} values for the sounding are presented in Table 1. The V_{s30} values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The V_{s30} value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth. This harmonic mean value reflects the equivalent single layer response.

The estimated error in the average V_{s30} value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.



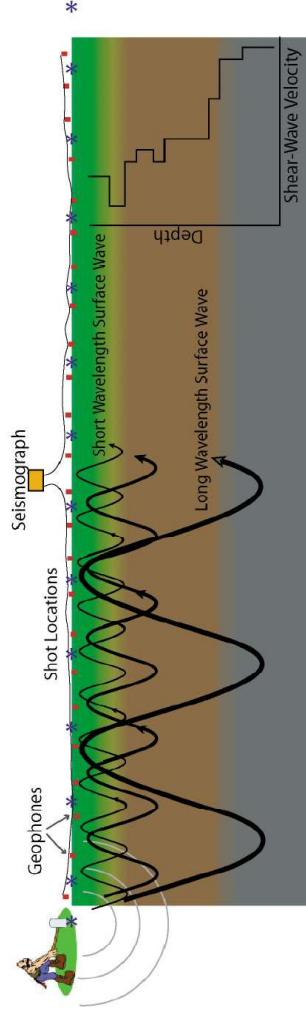
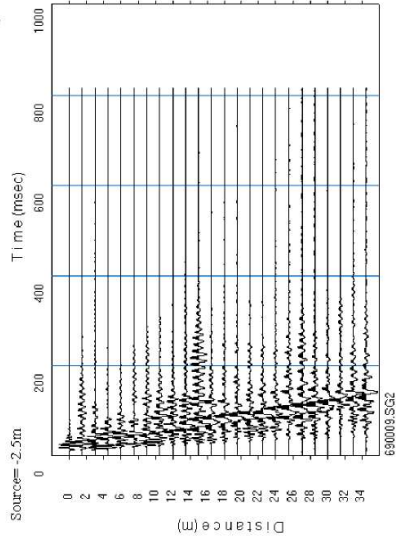
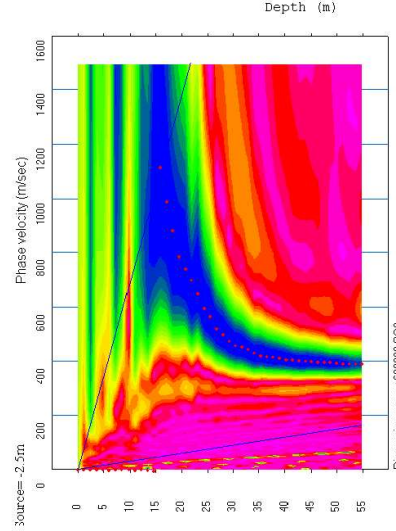


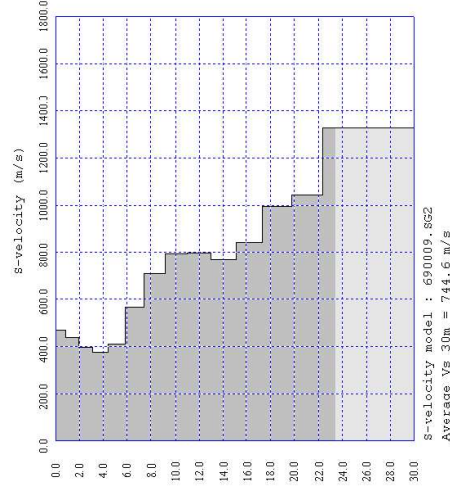
Figure 3: MASW Operating Principle



Raw Seismic Shot Record



Phase Velocity-Frequency Transformation indicating Dispersion Curve



1D Shear-Wave Velocity Profile from Inversion of Dispersion Curve

Figure 4: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model.



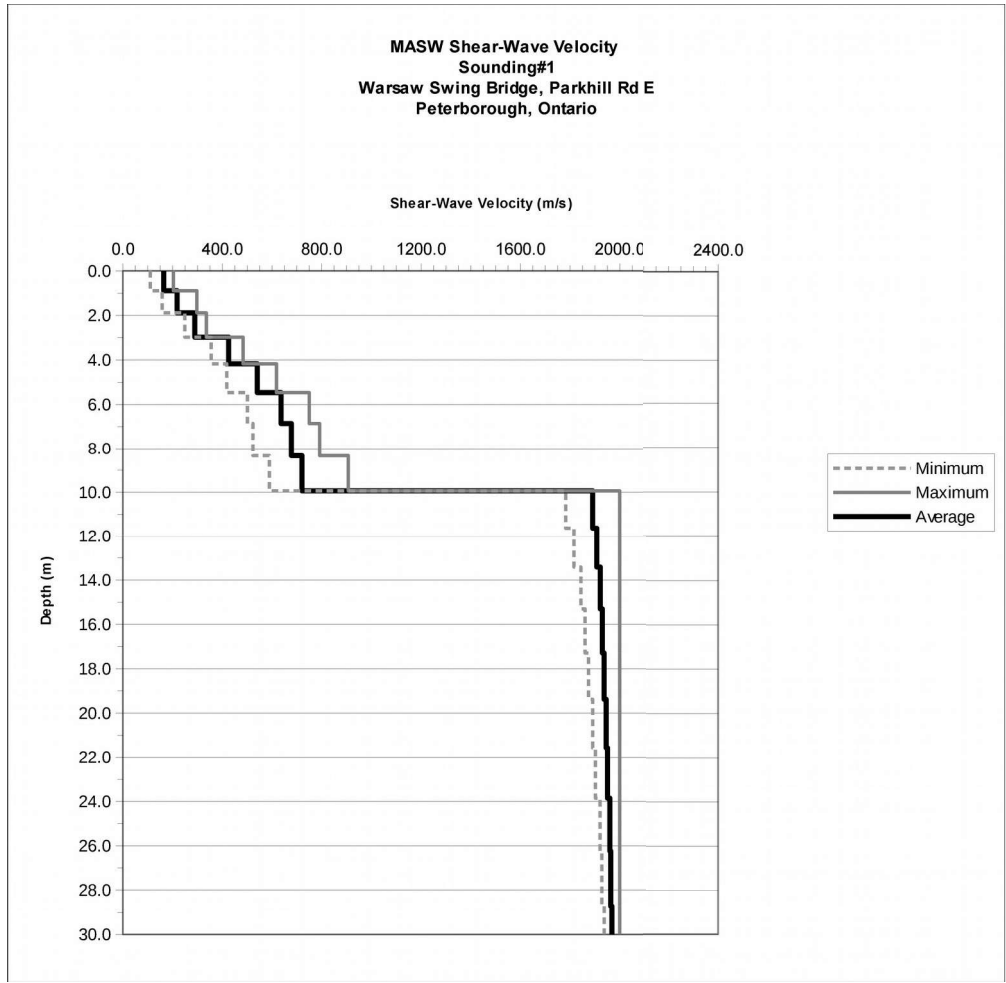


Figure 5: MASW Shear-wave Velocity Sounding



CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 1.

The MASW shear-wave models are presented in Figure 4. The results are summarized in Table 1. The background seismic noise levels at this site were moderate. The quality of the seismic records was good, however the resulting dispersion curves weren't well defined.

As is typical, the shear-wave velocities modelled using the MASW method were poorly constrained within the rock. Comparison with measured refracted P-wave velocities and estimates of Poisson's ratio can be used to better constrain the shear-wave models.

Simple critical distance calculations from the refracted wave arrivals suggest that the bedrock could be on the order of 10m deep. Refracted P-wave velocities of approximately 4000m/s were measured for the bedrock. The MASW velocity model has been constrained to the refraction results.

No borehole or geotechnical data was available at the time of this report.

Table 1: Calculated V_{s30} values (m/s) from the MASW data (0 to 30m)

Sounding	Minimum	Average	Maximum	Site Class
1	678	836	966	C*

* NBC 2010 Commentary "J" requirements

The calculated average V_{s30} values from the 1D MASW soundings collected was 836m/s +/- 15% to 20%.

The V_{s30} values calculated for the minimum and the maximum envelopes ranged from 678 to 966m/s.

Based on the average V_{s30} values (as determined through the MASW method) and table 4.1.8.4.A of the National Building Code of Canada, 2010 Edition, the investigated area is site class "C" ($360 < V_{s30} \leq 760$ m/s).

The use of Site Class 'B' is conditional on the requirements of Commentary 'J' sentence 100, specifically, "*Site Classes A and B, are not to be used if there is more than 3 m of soil between the rock surface and the bottom of the spread footing or mat foundation, even if the computed average shear wave velocity is greater than 760m/s*".

It must be noted that the site classification provided in this report is based solely on the V_{s30} value as derived from the MASW method and that it can be superseded by other geotechnical information. This geotechnical information includes, but is not



limited to, the presence of sensitive and/or liquefiable soils, more than 3m of soft clays, high moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2010 Edition for more information on the requirements for site classification.

This report has been written by Milan Situm, P.Geo.



Milan Situm, P.Geo.
Manager





SNC • LAVALIN

1164 Clyde Court
Kingston, Ontario, Canada, K7P 2E4
613.389.1781 - 613.389.4204

APPENDIX C

SITE SPECIFIC BASIC IMPACT ANALYSIS



Basic Impact Analysis

**Warsaw Road Swing Bridge 27 - Replacement
Trent-Severn Waterway
Parkhill Road East, Peterborough, Ontario**



April 2019



Environmental Impact Assessment Version Control

This section serves to control the development and distribution of revisions to the Environmental Assessment.

Document Number	Amendment Number	Date	Brief Description of Change
1	0	2019-04-11	Original





1. GENERAL PROJECT INFORMATION

1.1. Location:

Warsaw Road Swing Bridge 27 - Replacement
Trent-Severn Waterway
Parkhill Road East, Peterborough, Ontario
44° 19' 11.3232"N Latitude; 78° 18' 13.3848"W Longitude

1.2. Background:

The Warsaw Swing Bridge is a critical asset on the Trent-Severn Waterway (TSW) and safe and effective operation and maintenance of the bridge is essential to management of the TSW and associated navigation/transportation.

The Warsaw Road Swing Bridge is an unequal arm steel swing bridge constructed in 1956, carrying Warsaw Road (Parkhill Road E) over the TSW. The existing Bridge has an overall length of approximately 31.1 m, and width of 7.3 m.

The bridge has three separate substructure elements; the east abutment, west abutment and pivot pier. The east abutment wall forms the side of the waterway and features a stepped bearing seat and a concrete ballast wall that is integral with the sidewalk on the south side and the curb on the north side. The west abutment is similar, but set back from the waterway. Both abutment ballast walls are curved to accommodate the geometry of the bridge. The face of the pivot pier forms the other side of the waterway.

1.3. Land Ownership:

All work will be undertaken on Federal Lands under the jurisdiction of Parks Canada Agency (PCA) – TSW.





Figure 1: Google Earth aerial image of the general proposed project area.



Figure 2: Google Street View of typical view upstream (north) of Warsaw Swing Bridge



Figure 3: Google Street View of typical view downstream (south) of Warsaw Swing Bridge

2. PROPONENT INFORMATION

Wesley Little, Engineer
Parks Canada, Trent- Severn Waterway
1800 Walkley Rd.
Ottawa, ON K1H 8K3
Phone: (343) 548-3930
E-mail: wesley.little@canada.ca

3. PROPOSED PROJECT DATES

Planned commencement: February 2019
Planned completion: July 2019





4. INTERNAL PROJECT FILE # EA: TSW-2018-013 (I); R.30027479

5. **NOTE ON BASIC IMPACT ASSESSMENT DOCUMENT:**

The environmental constraints, best management practices and mitigation measures outlined within this Basic Impact Analysis (BIA) shall be adhered to and implemented accordingly. The information presented within this document may be appended to subsequent future BIA(s) for similarly-scoped projects, or for possible future amendments to this BIA to address changes in the scope of work of this project. Additional prescribed mitigation within the future BIA(s) are to be adhered to and implemented in conjunction with that of this (the Initial) BIA, with the exception of mitigation measures which are detailed to supersede specific mitigative measures outlined within (this) the Initial BIA.

6. PROJECT DESCRIPTION

6.1. General Scope and Project Components:

The overall intent of this project is to rehabilitate the bridge and as a result, increase the current down rated live load capacity, to support the full CL-625-ONT loading.

This includes a complete removal and replacement of the bridge's steel structure. The bridge items will be replaced with new members to fully support CL-625-ONT loading. New TL-4 traffic barriers will be installed (anchored to the new floor beam members). The sidewalk will be stiffened to new floor beams in order to meet CHBDC vibration requirements. The bridge's main longitudinal girders will be replaced. The girders will also be painted with a full three-coat system. Live load bearings will be replaced for upgraded live loads. Above-footing portions of the abutments will be replaced at the two abutments, complete with approach slabs to improve ride quality and seismic integrity. The approach guiderail, electrical and mechanical systems will be replaced to suit as well. New concrete ballast will also be installed to rebalance the upgraded structure.

Other recommended immediate repairs include:

- Repair to concrete foundations, including:
 - Abutments wall;
 - Wing walls;
 - Ballast walls; and
 - Bearing shelf above high-water mark.
- Repair to pivot pier and approaches;
- Removal and replacement of entire steel super-structure;
- Installation of new traffic controls; and
- Mechanical and Electrical replacements.
- Installation of HPU on north side of gate building, and potentially some modifications to the gate building itself.



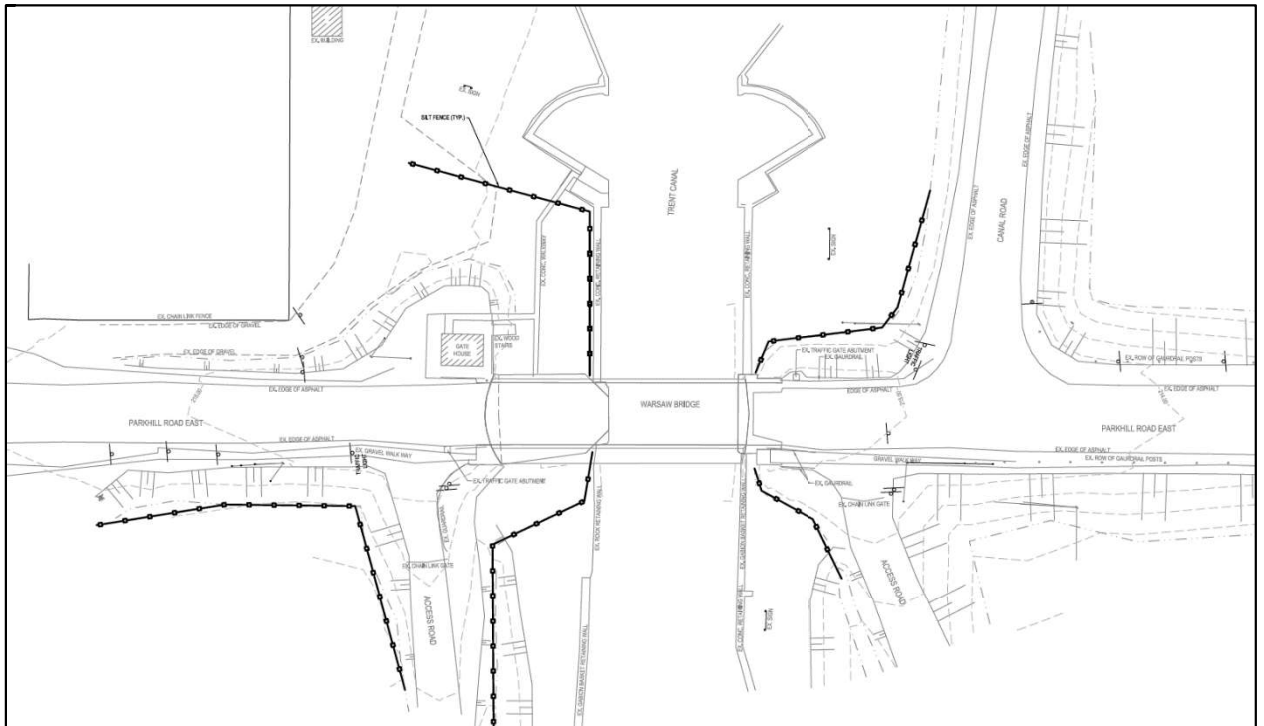


Figure 4: Anticipated Site Plan for the Bridge. See **Appendix B** for additional information.

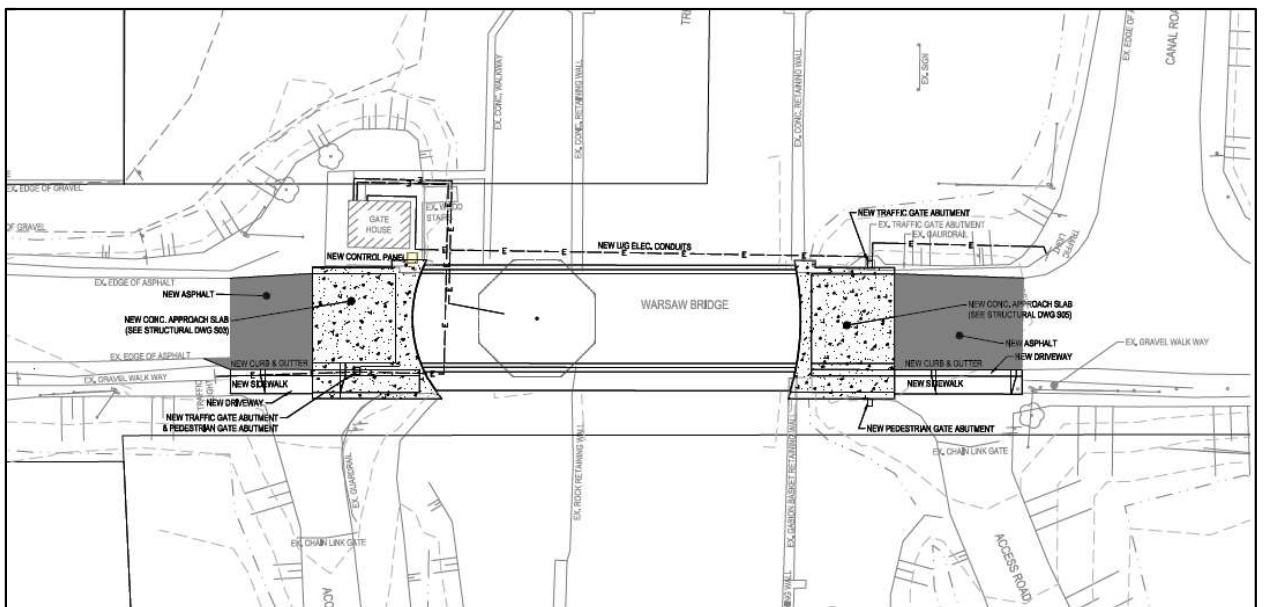


Figure 5: Anticipated Site Plan for the Bridge. See **Appendix B** for additional information.

6.2 Schedule:

Mobilization and site preparation is anticipated for Fall (October) 2019. The completion of the bridge replacement is anticipated for spring (May) 2020. ‘High risk’ or water-quality impacting activities such as concrete placement, is anticipated to be completed in the dry, during non-navigation season when the water channel is dewatered.



Project environmental constraints were considered as part of the design process:

- In-water works, which may occur, must be timed to adhere to appropriate fisheries timing windows (restriction from May 1st to June 30th) of any year to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed. Plan to minimize duration of in-water works wherever possible.
- Construction in areas of potential turtle habitat(s) during the turtle nesting season from May 15th to August 15th of any year should be avoided to best extent possible in order to protect potential local turtle residents.
- In compliance with the *Migratory Bird Convention Act (MBCA)*, no removal of trees or other vegetation during the breeding bird window from April 1st to August 31st is to take place of any year.

7. VALUED COMPONENTS POTENTIALLY AFFECTED

7.1. Navigability and Public Safety:

The TSW is a designated navigable waterway pursuant to the List of Scheduled Waters as defined by the *Navigation Protection Act (NPA)*. Navigation is thereby managed and regulated by Parks Canada as part of the TSW in accordance with the *Historical Canals Regulations (HCR)*.

No effects to navigability are expected during the bridge replacement, or the possible construction of any temporary in-water works associated with the project. Work is not anticipated to be undertaken within the navigation channel within the navigation season of the TSW. No effects to the navigability of the TSW are predicted post-construction. Repairs to this asset ensure that safe navigation continues on the TSW. Safety of both water-based and land-based visitors is a priority.

7.2. Water Quality:

The section of the canal associated with the construction site is (mostly) dewatered for the duration of the non-navigation season (see **Photos 11-15 of Appendix A**).

Although not anticipated, as planned works is scheduled to occur above the high-water mark, if required, the in-water work area for this sites will be isolated and/or dewatered for the non-navigation season. Some water, resultant from leakage of isolation barriers may pass through this area. By this, there is potential for contamination of water from spills and/or leaks from equipment. Also, potential of reduced water quality and clarity due to increased erosion, sedimentation, and transport of debris (e.g. discharge of waters).

Baseline water quality measures were taken near the project area prior to initiation of construction in order to get an accurate picture of background levels. Additional water quality measurements will be taken prior to the commencement of construction activities. This information will form the baseline for the mitigations measures outlined in this assessment.

Table 1: Baseline Water Quality for Warsaw Swing Bridge

Quality Component	Warsaw Guard Gate
Temperature (°C)	17.48
pH	8.07
Turbidity (NTU)	0.94

*Data Collected October 2nd 2017





7.3. Fish and Fish Habitat:

The waterbody upstream (north) of the Warsaw Bridge (R1) is 65 m long and 25 m wide, with a mean depth of 2.0 m and is located within the dug canal cut. This area is dominated by an organic, boulder and cobble substrate which offers little cover for fish. Other cover features such as large woody debris, submergent aquatic vegetation, and overhanging vegetation are also present. The riparian area ranges from narrow-to-wide and open-to-treed. Substrate/cover conditions are considered marginal; representing 15-30% stable habitat with minimal sediment deposition (ARCADIS, 2017).

The waterbody downstream (south) of the bridge (R2) is 80 m long and 17 to 38 m wide, with a mean depth of 2.5 m. This area is dominated by an organic substrate with some gravel and boulders which offers moderate cover for fish. Other cover features such as submergent aquatic vegetation are also present. The riparian area ranges from narrow-to-wide and open-to-treed. Substrate/cover conditions are considered marginal; representing 15-30% stable habitat with minimal sediment deposition (ARCADIS, 2017).

The R1 and R2 pools are predominantly deep and are subject to a slow-to-standing/deep velocity/depth condition. The Trent Canal has been altered for many years and is generally straight or gently curved, with no riffle features. The water level covers 100% of the channel width. The banks are stable (ARCADIS, 2017).

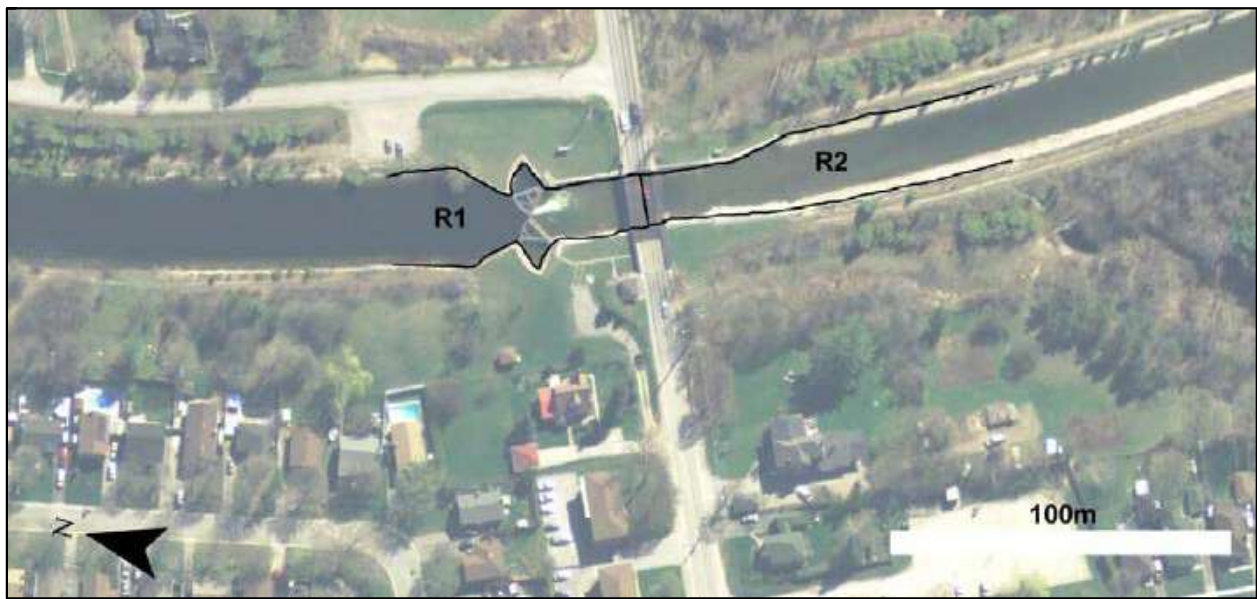


Figure 6: Waterbody reaches of the TSW within direct proximity to Warsaw Bridge (R1 = reach upstream of the bridge, R2 = reach downstream of the bridge) (ARCADIS, 2017).



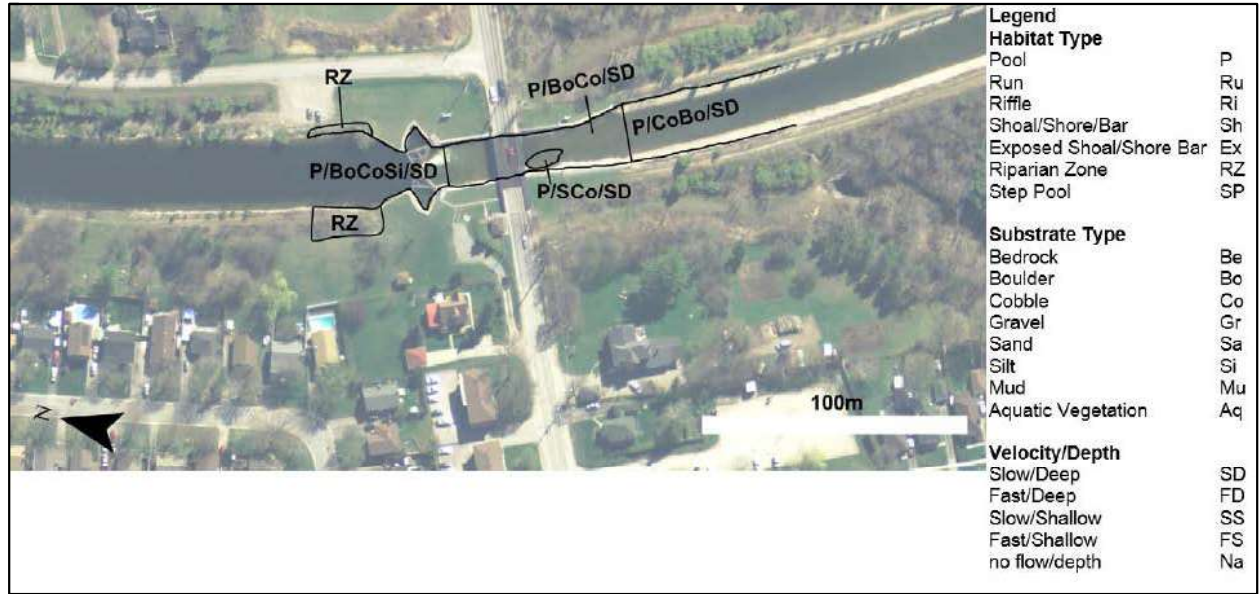


Figure 7: Habitat units, based on habitat type, substrate, and depth/velocity characteristics within waterbody reaches of the TSW within direct proximity to Warsaw Bridge (ARCADIS, 2017).

Table 2: Fish species which have been recorded to be observed, or are reported to possibly reside within proximity to, the Warsaw Swing Bridge and surrounding area.

FISH AND AQUATIC SPECIES			
Common Name	Scientific Name	Sp. Note	Source
FISH			
Black Crappie	<i>Pomoxis nigromaculatus</i>		FHA
Bluegill	<i>Lepomis macrochirus</i>		FHA
Bluntnose Minnow	<i>Pimephales notatus</i>		FHA
Brown Bullhead	<i>Ameiurus nebulosus</i>		FHA
Common Carp	<i>Cyprinus carpio</i>		FHA
Common Shiner	<i>Luxilus cornutus</i>		FHA
Iowa Darter	<i>Etheostoma exile</i>		FHA
Largemouth Bass	<i>Micropterus salmoides</i>		AA, FHA
Sunfish sp.	<i>Lepomis sp.</i>		FHA
Logperch	<i>Percina sp.</i>		FHA
Mottled Sculpin	<i>Cottus bairdii</i>		FHA
Muskellunge	<i>Esox masquinongy</i>		AA
Pumpkinseed	<i>Lepomis gibbosus</i>		FHA
Rock Bass	<i>Ambloplites rupestris</i>		FHA
Round Goby	<i>Neogobius melanostomus</i>	INV	EDM
Smallmouth Bass	<i>Micropterus dolomieu</i>		AA, FHA
Spottail Shiner	<i>Notropis hudsonius</i>		FHA
Walleye	<i>Sander vitreus</i>		FHA
White Sucker	<i>Catostomus commersonii</i>		FHA
Yellow Perch	<i>Perca flavescens</i>		FHA
INVERTEBRATE			
Chinese Mystery Snail	<i>Cipangopaludina chinensis</i>	INV	EDM
Common Periwinkle	<i>Littorina littorea</i>	INV	EDM





Rusty Crayfish	<i>Orconectes rusticus</i>	INV	EDM
Zebra Mussel	<i>Dreissena polymorpha (Pallas)</i>	INV	EDM
AQUATIC VEGETATION			
Cattail (Bulrush) sp.	<i>Typha sp.</i>	HX? INV?	2017-06 SV
European Common Reed	<i>Phragmites australis</i>	INV	EDM
European Frog-bit	<i>Hydrocharis morsus-ranae</i>	INV	EDM
Purple Loosestrife	<i>Lythrum salicaria</i>	INV	EDM

AA = Angler’s Atlas

EDM = EDDmaps

FHA = Fish Habitat Assessment Report 2017

HX = Hybrid

INV = Invasive Species

No fish Species at Risk (SAR) or SAR Critical Habitat (CH) are known to be present within vicinity to the Warsaw Street Swing Bridge.

Overall, fish habitat is considered poor for refuge, and marginal for adult, spawning and nursery habitat for most warmwater/coolwater fish species. There is marginal potential for habitat enhancement in this area (ARCADIS, 2017).

The work area is regularly de-watered for the winter non-navigation season, so any in/near-water works and activity is anticipated to be completed in the dry. See **Photos 11-15 of Appendix A** as an example of typical winter water levels of the associated project area. Near-water works are scheduled to occur completely in the dry, above the high-water mark, in the non-navigation (de-watered season).

7.4. Erosion and Sediment Control:

A Bedrock Geological Map of the site, obtained from Ontario Geological Survey (<http://www.mndm.gov.on.ca>), identified that the area surrounding the site is underlain by Paleozoic limestone bedrock belonging to the Middle Ordovician Simcoe Group, overlain with Phanerozoic Quaternary till and fine-textured Glaciolacustrine deposits. The canal area consists mainly of limestone.

Soils and landforms consisting of, and immediately surrounding, the guard gates, bridges and earthdams have been historically disturbed by development. This includes the building of the original canal infrastructure, municipal infrastructure, and residential development.

There is potential for contamination of soil from spills and/or leaks from equipment. Depending on winter conditions/snow cover, there is also potential for soil exposure resulting in erosion, sedimentation and slope instability.

7.5. Vegetation:

The Warsaw Bridge and earthdam areas are heavily influenced by past and present human development and activities. The footprint of the replacement bridge is essentially the same footprint of the existing bridge. The project area lies within the bridge operational grounds, parking areas and presently disturbed Peterborough Earthdam construction zone.

The majority of the area consist of manicured lawn, encompassed by un-kept, long-grass/scrubby areas. An assortment of common wild grasses, scrubby-plants, brush, climbing plants, assorted small trees, and wild flowers grow in the long-grassed field area, with a few mature trees (see **Figures 1-3 and Appendix A**).





It may be assumed that a large portion of these areas were previously disturbed and impacted from the bridge, earthdam, and access road/parking area construction and maintenance. Limited vegetation disturbance is anticipated to be restricted to lawned areas and currently disturbed areas from the Peterborough Earthdam rehabilitation. No vegetation removal is anticipated as part of the project.

7.6. Wildlife:

The area surrounding the Warsaw Swing Bridge construction area is likely utilized by a variety of aquatic and terrestrial wildlife.

Migratory birds utilize the vegetation adjacent to the bridge, and waterfowl can also be found on the water as well and on the surrounding lands. It is possible that there is turtle nesting habitat along the embankments up and downstream to the construction area.

Due to that vegetation will be disturbed, there is potential to affect birds and other wildlife species, both aquatic and terrestrial. Migratory birds, their nests and eggs are protected under the *MBCA (1994)*. Project works that are potentially disruptive activities to nesting birds, such as vegetation clearing, should be avoided during the nesting period.

7.7. Species at Risk:

The federal *Species at Risk Act (SARA)* provides protection to all SAR listed under *Schedule 1* of the Act. SAR which may be found within a 2.5 km radius of the project areas, both federally listed species and species listed under the *Ontario Endangered Species Act (ESA)*, have been identified using the National Heritage Information Center's (NHIC) database, the Atlas of Breeding Birds of Ontario (OBBA), the Ontario Reptile and Amphibian Atlas (ORAA), and the E-bird (EB) Hotspot Database of the Cornell Lab of Ornithology. These species can be found in **Table 3**.

Basic habitat characteristics for each species have been included in **Table 3** and an assessment given as to the likelihood of that species using habitat within the study area. The project site is not located within designated CH for any SAR species. For SAR which do not have CH described in a recovery strategy, mitigation measures will be employed to ensure that individuals and their habitat are protected.

7.7.1. Birds:

Confirmed observations which have been reported within approximately a 2.5 km radius of the site include Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*) Bobolink (*Dolichonyx oryzivorus*), Chimney Swift (*Chaetura pelagica*), Eastern Meadowlark (*Sturnella magna*), Eastern Wood Pewee (*Contopus virens*), Least Bittern (*Ixobrychus exilis*), Rusty Blackbird (*Euphagus carolinus*), and Wood Thrush (*Hylocichla mustelina*). A number of these sightings were located at the Peterborough Dufferin Cement pond, located ~ 350 m southeast of the bridge, however, none of these sightings appear to have occurred directly within the project area itself. Furthermore, to date, the presence and nesting of Barn Swallows and Chimney Swift at the bridge site has yet to be confirmed. However, Barn Swallows and Chimney Swifts are known to commonly nest on bridge structures and buildings.

7.7.2. Herpetiles:

Eastern Milksnake (*Lampropeltis triangulum*) and Western Chorus Frogs (*Pseudacris triseriata*) have been reported within the general area of the Warsaw Bridge by the ORAA.





Blanding's Turtle (*Emydoidea blandingii*) and Snapping Turtle (*Chelydra serpentina*) have been observed and reported within approximately a 2.5 km radius of the site by NHIC. In addition to this, the ORAA has reported Eastern Musk Turtle (*Sternotherus odoratus*), Midland Painted Turtle (*Chrysemys picta*), and Northern Map Turtle (*Graptemys geographica*) within the greater general area.

Blanding's Turtle, Midland Painted Turtle, Northern Map Turtle, and Snapping Turtle are spring nesters, laying eggs anywhere from May to late June-early July. They all may use sand and gravel banks along waterways, road shoulders, fissures in rocky shorelines and freshly dug gravel and soil. Eggs generally hatch between late August and late October. However, in the case of Painted Turtles, eggs can hatch in the fall or even overwinter, hatching in the following spring.

Conversely, following spring mating, Eastern Musk Turtles dig shallow excavations in soil, decaying vegetation and rotting wood or lay eggs in muskrat lodges, on the open ground, or in rock crevices. The eggs hatch in late summer or early fall.

The overall project area may provide limited breeding/laying habitat for several species of turtle, particularly along the eastern shoreline area directly adjacent to the river's edge, upstream of the Warsaw Bridge. The project's permanent footprint is not anticipated to encroach upon this area.

With respect to hibernation potential at the project site itself, as the canal is annually dewatered for non-navigation season, turtle overwintering activity is not likely to be present at this site.

7.7.3. Insects:

NHIC has reported Monarchs Butterflies (*Danaus plexippus*) to be present at the site. Furthermore, Common Milkweed (*Asclepias syriaca*) has been observed to be present within the 'wild' vegetative areas of the project site. As Monarchs Butterflies can be found wherever milkweed and wildflowers grow, it can be assumed that Monarchs may select to utilize the area.

7.7.4. Mammals:

Bats have been recently listed as endangered, attributed to species declines as a result of a fungal disease: White-nose Syndrome, which has accounted for at least 90% mortality rates (COSEWIC 2013). Little Brown Bats (*Myotis lucifugus*) are especially susceptible to this fungus. Winter hibernation habitats do not occur on site, however, summer roost sites may still be under the loose bark of dead trees, the hollows of trees, or man-made structures. The Northern Myotis (*Myotis septentrionalis*) and Tri-coloured Bats (*Perimyotis subflavus*) primarily prefer forested, natural cavities or loose leaves for roosting. This is as opposed to constructed features typically preferred by the Little Brown Myotis. Eastern Small-footed Bat (*Myotis leibii*) are known to roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. Importantly, all bats will use forested habitats beneath the canopy and will forage on the forest floor. Proximity to water is also an important habitat requirement.





7.7.5. Vegetation:

NHIC has reported a Butternut Tree (*Juglans cinerea*) within a 2.5 km radius of the project site. Butternut trees have not been recorded in any species inventory surveys to date of the project site and immediate surrounding area. Furthermore, no vegetation removal is anticipated for the project, so any Butternut specimens unaccounted for shall be protected and unaffected by the project.





Table 3: Federally and Provincially-Ranked Species with Potential to be found within the Project Area.

Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
BIRDS							
Bank Swallow ^{2,3,6}	<i>Riparia</i>	Threatened	Threatened	Threatened	Bank swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. The bank swallow migrates south for the winter, primarily to South America. Migration in U.S. and Canada peaks early-Aug/late-Sept. Spring return typically occurs between mid-March to June. Breeding activity typically occurs between April and August. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/bank_swallow_map_eng.pdf	No	No
Barn Swallow ^{2,3,6}	<i>Hirundo rustica</i>	Threatened	Threatened	Threatened	Nest almost exclusively on man-made structures (bridges, culverts, barns). The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces. Barn Swallows are long-distance migrants and fly from North American breeding grounds to wintering areas in Central and South America. Migration has been recorded third week of Jul, peaking mid-August, through early Oct, with stragglers through late Oct or early Nov. In southern Canada, adults start to return in the spring by the end of April and the first week of May, but the main influx occurs in mid-May, tailing off in early June. Breeding in Ontario typically takes place between May and August, with Nest construction starting in mid-May in Ontario. Map (Figure 1): https://www.ontario.ca/page/barn-swallow-recovery-strategy	Yes	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
Black Tern³	<i>Chlidonias niger</i>	Not at Risk	No Status	Special Concern	Shallow marshes, generally comprised of cattails. In Ontario, Black Terns are found scattered throughout the province, but breed mainly in the marshes along the edges of the Great Lakes. Breeding in Ontario typically takes place between early May and mid-August. Black Tern migrate south to central-America, the Atlantic coast and Mexico typically between mid-August and September, returning between mid-to-late April to mid—to-late May. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/black_tern_map_eng.pdf	No	No
Bobolink^{2,3,6}	<i>Dolichonyx oryzivorus</i>	Threatened	No Status	Threatened	Bobolink nest in tallgrass prairie and other open meadows, including hayfields. In Ontario, it is widely distributed throughout most of the province south of the boreal forest, although it may be found in the north where suitable habitat exists. Fall migration initiates Late July – early August; returning in spring around mid-May. Breeding in Ontario typically takes place between mid-May and mid-July. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_bblink_eo_map_eng.pdf	No	No
Canada Warbler³	<i>Cardellina canadensis</i>	Threatened	Threatened	Special Concern	The Canada Warbler breeds in a range of deciduous and coniferous, usually wet forest types, all with a well-developed, dense shrub layer. Dense shrub and understory vegetation help conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks. In Ontario, it is most abundant along the Southern Shield. It winters in South America, departing Canada in August, to return in late-April/early-May for breeding. Breeding activity typically takes place between late-May and early-August.	No	No





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					Map: https://wildlife-species.canada.ca/bird-status/dist-dist-eng.aspx?sY=2014&sL=e&sB=CAWA&sM=p1&sD=3240		
Chimney Swift^{2,6}	<i>Chaetura pelagica</i>	Threatened	Threatened	Threatened	Likely to be found in and around urban settlements where they nest and roost (rest or sleep) in chimneys and other manmade structures. They also tend to stay close to water as this is where the flying insects they eat congregate. Migrants move south in the late summer/early-fall (August – September), returning to Ontario in late-April, early-May. Breeding activity typically takes place between May and August. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/chimney_swift_map_eng.pdf	Yes	Possible
Eastern Meadowlark^{2,3}	<i>Sturnella magna</i>	Threatened	Threatened	Threatened	Nest in moderately tall grasslands, such as pastures and hayfields, but also nest in alfalfa fields, weedy borders of croplands, roadsides, orchards, shrubby overgrown fields, or other open areas. Small trees, shrubs or fence posts are used as elevated song perches. In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield but it also inhabits the Lake Nipissing, Timiskaming and Lake of the Woods areas. The peak period of fall migration extends from about 21 September through to about 10 November. In southern Ontario, spring migration extends from late March through much of May. Breeding activity typically occurs between May and August. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_es_me_lrk_map_en.pdf	No	No
Eastern Wood-pewee^{2,3,6}	<i>Contopus virens</i>	Special Concern	Special Concern	Special Concern	Edges of mixed or deciduous forests, intermediate-aged mature forests. It is most abundant in intermediate-age mature forest stands with little	Possible	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					understory vegetation. The Eastern Wood-pewee is a long distance migrant, wintering in the tropics. Fall migration begins mid to late August and peaks in early to mid-September. Birds typically return to northern breeding grounds in mid-May. Breeding activity typically occurs between mid-May to September. Map (Figure 5): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/eastern-wood-pewee-2012.html		
Grasshopper Sparrow³	<i>Ammodramus savannarum pratensis</i>	Special Concern	Special Concern	Special Concern	It lives in open grassland areas with well-drained, sandy soil. It will also nest in hayfields and pasture, as well as alvars, prairies and occasionally grain crops such as barley. It prefers areas that are sparsely vegetated. Its nests are well-hidden in the field and woven from grasses in a small cup-like shape. The Grasshopper Sparrow can be found throughout southern Ontario, but only occasionally on the Canadian Shield. It is most common where grasslands, hay or pasture dominate the landscape. The Grasshopper Sparrow is a short-distance migrant and leaves Ontario in the late-summer/fall (mid-August – September) to migrate to the southeastern United States and Central America for the winter, returning in May. Breeding activities typically occur between June and early-August. Map (Figure 1): http://cossaroagency.ca/wp-content/uploads/2017/06/COSSARO-Grasshopper-Sparrow-Final-Evaluation-with-FR-FINAL-s.pdf	No	No
Least Bittern^{2,3,5}	<i>Ixobrychus exilis</i>	Threatened	Threatened	Threatened	The Least Bittern breeds strictly in marshes dominated by emergent vegetation surrounded by areas of open water. Most breeding grounds in Canada are dominated by cattails, but breeding also occurs in areas	No	No





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					with other robust emergent plants and in shrubby swamps. Breeding habitats are occupied from mid-May to mid-September. For winter months, Least Bitterns migrate between late-August to early-October to the southern United States, Mexico and Central America. Migrants return to Ontario typically between April – mid-May. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/least_bittern_map_eng.pdf		
Rusty Blackbird⁶	<i>Euphagus carolinus</i>	Special Concern	Special Concern	Special Concern	Breeding habitat is characterized by coniferous-dominated forests adjacent to wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps and beaver ponds. Fall migrants typically leave in October. Spring Migrants arrive in Ontario in Late May. Breeding activities occur between late-May and late July. Map (Figure 8): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/rusty-blackbird-2017.html	Possible	Possible
Wood Thrush^{2,3}	<i>Hylocichla mustelina</i>	Threatened	Threatened	Special Concern	The wood thrush lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing perches. These birds prefer large forests, but will also use smaller stands of trees. They build their nests in living saplings, trees or shrubs, usually in sugar maple or American beech. The Wood Thrush is a long-distance migrant, wintering in southern America and Mexico. Individuals depart northern breeding areas mid-Aug to mid- Sep. Spring migrants typically arrive mid to late May. Breeding Activity occurs between late-May and August.	No	No





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					Map (Figure 7): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/wood-thrush-2012.html		
HERPETILES							
Blanding's Turtle^{2,4}	<i>Emydoidea blandingii</i>	Endangered	Threatened	Threatened	Blanding's Turtles can be found in several types of freshwater environments, including lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. They will travel long distances overland (>410m) for basking and nesting sites. Blanding's Turtles are spring nesters, laying eggs anywhere from May to late June-early July. They may use sand and gravel banks along waterways, road shoulders, fissures in rocky shorelines and freshly dug gravel and soil. Eggs generally hatch between late August and late October. Blanding's Turtles hibernate in the mud at the bottom of permanent water bodies from late October until the end of April. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_bla_tur_map_eng.pdf	Yes	Possible
Eastern Milksnake⁴	<i>Lampropeltis triangulum</i>	Special Concern	Special Concern	No Status	Found in a wide variety of habitats, from prairies, pastures, and hayfields, to rocky hillsides and a wide variety of forest types. Often in close proximity to water. The Milksnake hibernates communally underground, in rotting logs or in the foundations of old buildings from late-October/November to early-April. Females lay their eggs in late-June or early-July, with eggs hatching in late-August or early-September. Maps (Figure 4 and 6): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/eastern-milksnake-2014.html	Yes	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
Eastern Musk Turtle ⁴ (Stinkpot)	<i>Sternotherus odoratus</i>	Special Concern	Special Concern	Special Concern	Eastern Musk Turtle require shallow water with little or no current, and soft earth to bury into when they hibernate. It nests from late May to early July, usually within 45 metres of water. Nesting habitat is variable, but it must be close to the water and exposed to direct sunlight. Eastern Musk Turtle prefer to lay eggs in rotting vegetation. Generally, the nests contain from two to five eggs and are quite shallow; sometimes the female lays her eggs under logs or on open ground. Hatchlings emerge in the fall and are approximately two centimetres in length. Hibernation takes place between October and April. Map: http://files.ontario.ca/environment-and-energy/species-at-risk/eastern_musk_turtle_map_eng.pdf	Yes	Possible
Midland Painted Turtle ^{4,5}	<i>Chrysemys picta marginata</i>	Special Concern	No Status	No Status	Prefers slow moving rivers, streams, ponds, lakes, and marshes with muddy bottoms, lots of submerged vegetation and exposed rocks, logs and dead heads; utilized for basking. Females nest from late May to early July, digging their nest in loamy or sandy soil in sunny areas. The clutch contains from three to 14 eggs. Hatchlings may emerge in the fall but sometimes overwinter in the nest and emerge the following spring. Hibernation typically occurs between October to March. Map: https://en.wikipedia.org/wiki/Painted_turtle#/media/File:Painted_Turtle_Distribution_alternate.svg	Yes	Possible
Northern Map Turtle ⁴	<i>Graptemys geographica</i>	Special Concern	Special Concern	Special Concern	The Northern Map Turtle inhabits both lakes and rivers, showing a preference for slow moving currents, muddy bottoms, and abundant aquatic vegetation. Their habitat must contain suitable basking sites, such as rocks and deadheads, with an unobstructed view from	Yes	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					<p>which a turtle can drop immediately into the water if startled. In winter, the turtles hibernate on the bottom of deep, slow-moving sections of river. Hibernation typically occurs between October and April. Northern Map Turtles are spring nesters, laying eggs anywhere from May to late June-early July. They may use sand and gravel banks along waterways, road shoulders, fissures in rocky shorelines and freshly dug gravel and soil. Eggs generally hatch between late August and late October. In some cases the hatchlings overwinter in the nest In southern Ontario, it lives primarily on the shores of Georgian Bay, Lake St. Clair, Lake Erie and Lake Ontario, and along larger rivers including the Thames, Grand and Ottawa.</p> <p>Map: http://files.ontario.ca/environment-and-energy/species-at-risk/northern_map_turtle_map_eng.pdf</p>		
Snapping Turtle^{2,4}	<i>Chelydra serpentina</i>	Special Concern	Special Concern	Special Concern	<p>Usually found in large bodies of water, but will sometimes inhabit small ponds. This species may inhabit surprisingly small wetlands, ponds and ditches. It hibernates in the mud or silt on the bottom of lakes and rivers, usually not too far from the shore. Hibernation typically occurs between October and April. Rarely leave water except to nest and migrate to overwintering habitat. Snapping Turtles are spring nesters, laying eggs anywhere from May to late June-early July. They may use sand and gravel banks along waterways, road shoulders, fissures in rocky shorelines and freshly dug gravel and soil. Females will use almost any area they can excavate. A single clutch usually consists of between 40 and 50 egg. Eggs generally hatch between late August and late October.</p>	Yes	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					Map: http://files.ontario.ca/environment-and-energy/species-at-risk/snapping_turtle_map_eng.pdf		
Western Chorus Frog⁴	<i>Pseudacris triseriata</i>	Threatened	Threatened	No Status	Marshes or wooded wetland areas; it is found on the ground or in low shrubs and grass. The Western Chorus Frog is very rarely found in permanent ponds. The species hibernates in its terrestrial habitat, under rocks, dead trees or leaves, or in loose soil or animal burrows, even though these sites are sometimes flooded. Hibernation typically occurs between October and March. In Canada, the Western Chorus Frog breeds very early in the spring, often while ice is still present mainly in April, sometimes beginning as early as the end of March, with calling sometimes continuing until mid-May. This frog breeds in almost any fishless pond with at least 10 centimetres of water. The female lays a series of small egg masses, which are attached to vegetation. The eggs hatch within a few weeks, and the tadpoles finish transforming by early summer or midsummer. The Western Chorus Frog is among the first species to call in the spring. Maps (Figures A-5, A-6 & A-7): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/western-chorus-frog-canadian-shield-population.html	No	No
INSECTS							
Monarch Butterfly⁵	<i>Danaus plexippus</i>	Endangered	Special Concern	Special Concern	Monarchs can be found wherever milkweed and wildflowers grow. This includes abandoned farmland, along roadsides, and other open spaces. Eggs are laid singly on the underside of a young leaf of a milkweed plant during the spring and summer months. Monarch metamorphosis from egg to adult occurs during the warm summer temperatures in as little as 25 days,	Yes	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					<p>extending to as many as seven weeks during cool spring conditions Monarch butterflies are not able to survive the cold winters of Canada and most of the United States so they migrate south and west each autumn to escape the cold weather. The monarch migration usually starts in about September to October but may initiate earlier if the weather turns cold sooner than that. The monarch butterflies will spend their winter hibernation in Mexico and some parts of Southern California.</p> <p>Map 1: http://www.mission-monarch.org/monarch-news/</p> <p>Map 2 (Figure 5): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/monarch-2016.html</p>		
MAMMALS							
Eastern Small-footed Bat	<i>Myotis leibii</i>	No Status	No Status	Endangered	<p>Often found hibernating in same locations as Little Brown Myotis and Northern Myotis, but they tend to occupy cooler, drier areas of the cave. Hibernation typically occurs between November and early-April. In summer they forage at night and roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. Mating most often occurs in autumn and the female stores the male's sperm throughout hibernation in the winter. Fertilization occurs in the spring once the females are active again, and gestation occurs between 50–60 days with young being born in late May and early June. The eastern small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce</p>	Possible	Possible



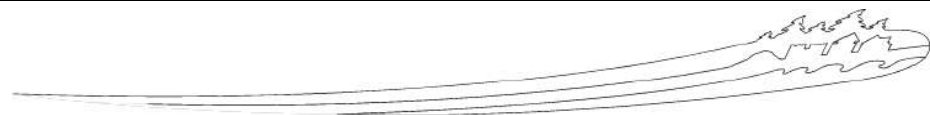


Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					Peninsula, the Espanola area, and Lake Superior Provincial Park. Map (figure 3): https://www.ontario.ca/page/eastern-small-footed-myotis-recovery-strategy#section-7		
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered	Endangered	Little Brown Myotis hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. In summer they forage at night and roost in trees and buildings during the day. Most Little Brown Bats of more than one year old will mate in the fall when great groups swarm together. Females will store the males' sperm throughout the winter until they ovulate in the spring. After a gestation of 50 to 60 days, depending on the condition and age of the female, a single pup is born in June or July. The little brown bat is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. Maps (Figures 1 & 15): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/little-brown-myotis-bat-proposed-2015.html	Possible	Possible
Northern Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered	Endangered	Similar habitat preferences to Little Brown Myotis - associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. They bats hibernate from October or November to March or April, most often in caves or abandoned mines. The Northern Myotis engages in mating in the fall, right before hibernation. Females store sperm over the winter and ovulate in the spring, delaying pregnancy until food resources are available again. They arrive at their maternity roosts around mid-May, and pups are born in late May or June following a 50-60	Possible	Possible





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					<p>day gestation period. Females give birth to just one pup per year. This bat is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.</p> <p>Maps (Figures 2 & 15): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/little-brown-myotis-bat-proposed-2015.html</p>		
Tri-coloured Bat	<i>Perimyotis subflavus</i>	Endangered	Endangered	Endangered	<p>Often found hibernating in same locations as Little Brown Myotis and Northern Myotis – abandoned mines and caves. Hibernation typically occurs between October and April. Males and females copulate in the fall and fertilization is delayed until the spring when females emerge from hibernation, although some tri-colored bats mate again in the spring. Gestation lasts at least 44 days. Offspring, normally referred to as pups, are born from June to mid-July. Tri-colored bats usually have two pups but can have one to three. They forage over water and along streams in the forest This bat is found in southern Ontario and as far north as Espanola near Sudbury. Because it is very rare, it has a scattered distribution. It is also found from eastern North America down to Central America.</p> <p>Maps (Figures 3 & 15): https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/little-brown-myotis-bat-proposed-2015.html</p>	Possible	Possible
VEGETATION							
Butternut^{2,5}	<i>Juglans cinerea</i>	Endangered	Endangered	Endangered	In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-	Possible	No





Common Name	Scientific Name	COSEWIC	SARA Status	ESA Status	Preferred Habitat	Habitat Potential on Project Site	Likelihood to be Found on Project Site
					<p>drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil. This species does not do well in the shade, and often grows in sunny openings and near forest edges. In Ontario, this species is found throughout the southwest, north to the Bruce Peninsula, and south of the Canadian Shield.</p> <p>Map: http://files.ontario.ca/environment-and-energy/species-at-risk/butternut_map_eng.pdf Map 2: https://files.ontario.ca/699-1-1en-map-2.pdf</p>		

¹COSEWIC Draft Critical Habitat Mapping

²NHIC

³Atlas of Breeding Birds of Ontario

⁴Ontario Reptile and Amphibian Atlas

⁵SAR Field Observation

⁶eBird Hotspot Database

Critical Habitat identified in 5 km x 5 km square

Potentially found on the site





Due to the nature and the location of the project and the environmental setting, the species identified as having the most potential to be within the vicinity of the project site and possibly affected by the work are:

- Barn Swallow
- Chimney Swift
- Eastern Wood-pewee
- Rusty Blackbird
- Blanding’s Turtle
- Eastern Milksnake
- Eastern Musk Turtle
- Midland Painted Turtle
- Northern Map Turtle
- Snapping Turtle
- Monarch Butterfly
- Eastern Small-footed Bat
- Little Brown Myotis
- Northern Myotis
- Tri-coloured Bat

7.8. Air Quality and Noise:

The project site is located within a largely developed area bordered by some natural landscapes and residential property. Other than the road and associated vehicle activity, there are little-to-no ambient noise/pollution generating sources. Air quality in the area is assumed to be good.

The use of diesel-powered machinery and concrete may result in temporary, localized effects on air quality around the project site. Noise from construction may be disruptive for property owners adjacent to the project sites, recreational users of the associated lands adjacent to the project site.

7.9. Invasive Species:

As the project involves soil and vegetation disturbance activities, and work adjacent to water, there is a possibility for invasive species to be accidentally introduced into and/or spread throughout the project site.

The following invasive species have been recorded and confirmed within the TSW and/or within proximity of the project site location:

Table 4: Invasive Species within proximity of project site location

Common Name	Scientific Name	# EDDmapS Records within ~5 km Radius
Black Locust	<i>Robinia pseudoacacia</i>	2
Boxelder Maple	<i>Acer negundo</i>	8
Chinese Mysterysnail	<i>Cipangopaludina chinensis</i>	1
Coltsfoot	<i>Tussilago farfara</i>	1
Common Periwinkle	<i>Littorina littorea</i>	8
Dames Rocket	<i>Hesperis matronalis</i>	4
Dog Strangling Vine	<i>Vincetoxicum rossicum</i>	33
European Buckthorn	<i>Rhamnus cathartica</i> L.	68
European Common Reed	<i>Phragmites australis</i>	50
European Frog-bit	<i>Hydrocharis morsus-ranae</i>	1
Garlic Mustard	<i>Alliaria petiolata</i>	49
Giant Hogweed	<i>Heracleum mantegazzianum</i>	3
Japanese Knotweed	<i>Fallopia japonica</i>	17
Multiflora Rose	<i>Rosa multiflora</i>	2
Norway Maple	<i>Acer platanoides</i>	1





Purple Loosestrife	<i>Lythrum salicaria</i>	5
Round Goby	<i>Neogobius melanostomus</i>	6
Rusty Crayfish	<i>Orconectes rusticus</i>	3
Scots Pine	<i>Pinus sylvestris</i>	1
Tatarian Honeysuckle	<i>Lonicera tatarica</i>	2
Wild Parsnip	<i>Pastinaca sativa</i> L	8
Yellow Iris	<i>Iris pseudacorus</i>	2
Yellow Sweet-clover	<i>Melilotus officinalis</i>	1
Zebra Mussel	<i>Dreissena polymorpha</i> (Pallas)	12

See <https://www.eddmaps.org/ontario/> for further information on invasive species sightings

7.10. Cultural Resources:

For the reconstruction of the Warsaw Bridge, a Cultural Resource Impact Analysis (CRIA) is required. The CRIA is now a component of the Agency’s Project Management Standard and is to be considered as part of each request for project approval. Cultural Resource Management (CRM) general mitigation measures are incorporated into this BIA by PCA (see **Section 9** below), however a more detailed assessment will be completed as part of a CRIA.

The proposed project involves a landscape that is a cultural resource of heritage value. An updated Heritage Value Statement (HVS) may be required in order to provide further information on the heritage value and identify character-defining elements of the key elements in the landscape that will be impacted by this project. The heritage value ascribed to a cultural resource guides conservation efforts and investments.

7.11. Archaeology:

With any project that involves disturbing the landscape and the area around historic structures, there is the potential to impact archaeological resources (both terrestrial and aquatic). As part of the CRIA process, an Archaeological Assessment (AOA) should be completed for the project area. This includes vehicular access routes, staging areas and areas proposed for signage and fencing. Based on the results of the AOA, an Archaeological Impact Assessment (AIA) and/or additional mitigation measures may be required prior to construction activities. This BIA may be amended to include these recommendations.

7.12. Health and Safety:

The health and safety of on-site workers and members of the general public within vicinity of the work areas must be ensured throughout the duration of construction. This may be enforced by restricting public accessibility of the project sites, and ensuring proper compliance with Health and Safety procedures and mitigation by work personnel.

8. EFFECTS ANALYSIS

The following sections outline the potential impact of the proposed works on valued components in the study area.

This project takes place within close proximity to residential properties and lands maintained and utilized for the TSW Lock system. The locks, bridge and associated park areas are heavily influenced by past and





present human development and activities. See **Figures 1 – 3** above for imagery of the general project site area and surrounding environmental conditions.

8.1. Water Quality, Fish and Fish Habitat:

Sensitive fish habitat is not anticipated at the project site as the majority of near-water works are anticipated to occur completely in the dry, above the high-water mark, in the non-navigation (dewatered season). Possible activities occurring within navigation season (prior to navigation fall closure and dewatering of the canal) are anticipated to be solely terrestrial-based and above the high-water mark, in the dry.

Potential environmental effects of project activities on fish and fish habitat could include, interference with biological time periods (i.e., migration or spawning), the addition of suspended solids into the water column through erosion and sedimentation, potential stranding of fish during dewatering, and direct mortality of fish. No alterations are anticipated to the dewatered canal during construction activities, and the canal will be restored to pre-construction conditions prior to being re-watered.

There is potential for fish to be present within the canal and to become stranded within residual pools of water in the dewatered area; with this, any stranded fish in the dewatered area must be live captured and released.

The planned work in this location can be conducted with the proper and efficient implementation of the appropriate Best Management Practices (BMPs), mitigation measures, and timing phases of in/near-water works, such that there are minimal adverse impacts to the environment.

8.2. Erosion and Sediment Control:

The use of heavy machinery, removal of vegetation, use of concrete, and the potential of in/near-water works increases the risk of soil disturbance and sediment movement. Vegetation removal and excavation activities will be kept to the minimum area required for construction activities and will be appropriately managed through the installation and maintenance of effective erosion and sediment control measures. By restricting work activities to within areas identified in approved site plans and previously disturbed areas, in addition to employing BMPs, mitigation and monitoring, adverse impacts shall be further minimized (see **Section 9**).

8.3. Vegetation:

Vegetation disturbance is essentially limited to lawned areas which have been heavily influenced by (historical) human activity, and would thereby not be considered significant or specialized habitat. It may be assumed that a large portion of these areas were previously disturbed and impacted from the historical lock, bridge and earthdam construction and maintenance. Such vegetation is not rare or exclusive to the areas to be impacted, and is readily available within the surrounding area of the project site. By this, the anticipated vegetation disturbance is not considered a significant or adverse impact to the environment.

Vegetation loss and disturbance will be kept to a minimum area required for construction activities. Should it be required, a revegetation planting plan may be developed to replace and compensate for trees/vegetation removed or damaged during the project.





8.4. Wildlife:

The project's site mobilization and clearing activities will largely take place outside of fish, reptile, amphibian, bird and many mammals' nesting/breeding season. Measures shall be put in place in order to establish barriers to prevent and discourage wildlife from accessing the site throughout the duration of the construction process. Also, attractants (i.e. waste) shall be regularly removed from site to further deter the presence of wildlife in the work area.

Reptiles and amphibians may still be found on site as they migrate to and from overwintering or nesting habitat (in the case of turtles), or as they forage (in the case of snakes). Mitigation measures employed to reduce the risk of turtles from entering the site, shall also be effective in reducing the risk of snakes and amphibians from entering the site.

Although not anticipated, all vegetation removal will be undertaken outside of the important migratory bird nesting period. If this is not feasible, a certified biologist must screen the area for nests prior to any cutting. Identified nests are to be left undisturbed until young have successfully fledged the nest.

Foraging opportunities for wildlife may be impacted by the disturbance (i.e. noise, dust, smells, etc.) generated during construction, but such disturbance will be temporary in nature. Other viable and diverse landscape is readily available outside of the construction zone.

With the proper implementation of mitigation measures, there should be no residual negative impact to wildlife.

8.5. Species at Risk:

As identified in **Table 3** above, 15 SAR have the potential to be present within the project area; Barn Swallow, Chimney Swift, Eastern Wood-pewee, Rusty Blackbird, Blanding's Turtle, Eastern Milksnake, Eastern Musk Turtle, Midland Painted Turtle, Northern Map Turtle, Snapping Turtle, Monarch Butterfly, Eastern Small-footed Bat, Little Brown Myotis, Northern Myotis, and Tri-coloured Bat.

On a daily basis, an inspection or sweep of the work area shall be performed prior to commencement of project works and activities to ensure that snakes, turtles, SAR, and any other wildlife are not present in the work area. SAR training will be required for all employees before they begin work on site, with a focus on Barn Swallows and Chimney Swift. Such material can be incorporated as part of the Environmental Management Plan (EMP) to be provided to PCA. Employees must be able to identify SAR with potential to be present on the site and know the proper procedures to follow should a SAR be encountered.

If discovered, work within the immediate vicinity of the individual shall stop and the specimen is to be left alone and permitted to exit the project site of its own will. Should this not be possible (i.e. individual is injured or entrapped), PCA is to be contacted for further guidance.

Key project mitigations shall include (but are not limited to – see **Section 9** below for additional mitigation):

- The contractor is to ensure that all construction crews are trained in how to identify SAR species and provided with the protocols detailing who to contact, information to document and actions to take if a SAR is found (e.g., all work temporarily stopped until advised by the biologist);





- The contractor is to ensure that pre-stressing and visual sweeps are completed by qualified personnel will be conducted prior to grubbing and site preparation;
- Exclusion fencing will be necessary to prevent SAR from entering the work zone;
- Soils will be protected by laying geotextile and covering with a suitable depth of gravel to prevent crushing/compaction;
- Where feasible/applicable, stumps will be ground down, rather than completely removed by grubbing in attempts to preserve these features. If grinding is not feasible, this shall be identified within the EMP and require acceptance by PCA;
- Brush and mulch piles, which may attract snakes, will not be stored on site, or shall be isolated with exclusion fencing (i.e. sediment fencing); and
- Areas will be actively restored upon de-mobilization.

8.5.1. Birds:

Construction activities are scheduled between fall 2019 and winter 2019/2020; all vegetation removal/ disturbance is then scheduled to take place outside of the bird-breeding window of April 1st to August 31st. This coincides with the timing for when the Barn Swallow, Chimney Swifts, Eastern Wood-Pewee, and Rusty Blackbird would be migrating or occupying winter habitat ranges, and would thereby not likely be present on site or affected by ongoing site activities.

To date, the presence of Barn Swallows and Chimney Swift at the bridge site has yet to be confirmed. However, Barn Swallows and Chimney Swifts are known to commonly nest on bridge structures and buildings.

Despite this possibility, as the area contains a wide mixture of vegetation, ranging from treed and scrubby areas to open, sparse and long-grassed areas, in addition to residential buildings and man-made structures, the impacted areas in question are not significant, nor specialized. Much more viable and suitable habitat is widely available within proximity to the project area.

Given the ample variety of nesting habitat within the surrounding vicinity of the Swing Bridge area, there is no anticipation that the temporary lack of nesting habitat access (access to the bridge structure) outside of breeding/nesting season, due to the project would adversely impact Barn Swallow and Chimney Swift nesting and presence in the area.

Barn Swallow lay earlier than other swallows; laying dates range from the 10th of May to the 21st of August in Ontario. Roosts start to build up in July, peak in early to mid-August and are negligible by September. Barn Swallows may use nests from previous years, and second broods are common in Ontario and usually occur in the same nest. Swallows will often repair and rebuild old or previously used nests.

Chimney Swift over-winter in South America, returning to Ontario in late-April, early-May. Swifts frequently nest and roost in chimneys and other man-made structures.

The contractor is to ensure that prior to construction, an inspection for nests within the construction area shall be completed by a certified biologist. Should empty nest structures be observed at this time upon the bridge, PCA EA is to be contacted for further guidance and direction.





Should construction extend into spring 2020 nesting and breeding season, bird deterrent meditative strategies (i.e. deflectors, roosting barriers, daily scans and removal of preliminary nest structures, etc.) should be employed to discourage and prevent the spring nesting of Barn Swallows and Chimney Swifts in the work area.

Furthermore, should active nests within the work area be identified and be required to be removed, PCA should be contacted for further direction.

With this, it is unlikely that any of the above-listed avian SAR would be adversely impacted in any way resultant of the project and/or its associated activities.

8.5.2. Herpetiles:

Given that the anticipated timing of the project is scheduled to take place from fall to mid-winter when most (if not all) Herpetiles are engaged in seasonal hibernation activities and not likely present/active on site, the probability of adverse incidences or encounters between herpetiles due to construction activity, is low-to-negligible. Furthermore, mitigation measures preventing/deterring herpetile access to the site, shall be already in place prior to spring emergence and completion of seasonal hibernation activities.

8.5.2.1. Snakes:

As the majority of the land area to be impacted by the anticipated project activities are restricted to areas which do not match the general habitat requirements for overwintering of snakes (i.e. hibernacula-suitable structures; fallen logs, wood debris piles, rock piles, etc.), the overwintering survivability of snakes (SAR and non-SAR) should not be impacted due to lack of or destruction of viable habitat.

The main impact to snakes and amphibians possibly residing in the area is the potential to temporarily exclude/deter individuals from transient habitat throughout the project duration, as well as destruction of potential summer feeding and basking habitat.

With increased traffic within the construction site and associated access road, there raises the potential for herpetiles to be injured/killed by moving vehicles.

Herpetile exclusion fencing placed around the laydown, staging and stockpile/storage area, and along the access road, shall be required. Guidance is available in the document titled Species at Risk Branch, Best Practices Technical Note, Reptile and Amphibian Fencing, Ver. 1.1, developed by the Ontario Ministry of Natural Resources and Forestry.

8.5.2.2. Turtles:

Blanding's Turtle, Eastern Musk Turtle, Midland Painted Turtle, Northern Map Turtle, and Snapping Turtle may reside within proximity to the project site.

It is expected that activities such as soil excavation, stock piling of materials, and other forms of landscape disturbance has the potential to attract turtles to the area for nesting. Due to that the project is scheduled to take place over the course of multiple seasons, temporary reptile exclusion fencing shall be required to be installed completely around gravel and soil stockpiles and all other disturbed areas in order to prevent and discourage turtle nesting in the project area. Regular site inspections prior to the commencement of construction





activities shall be conducted to observe for the possibility of new nesting sites or individual specimens.

Should evidence of nesting or a turtle be discovered, all work within the immediate vicinity of the nest/individual is to cease, and PCA EA staff are to be notified for further guidance. Additional measures to avoid impacts may be required before work can resume. If found in the project area, turtles may need to be relocated prior to commencing work (with permits required from Ontario Ministry of Natural Resources and Forestry (OMNRF) for relocation).

Near-water works are anticipated to occur completely in the dry, above the high-water mark, in the non-navigation (de-watered season). As this area will be exposed/be extremely shallow with winter water levels, this area is not-likely utilized as viable overwintering habitat by turtles and will only be temporarily unavailable for a single season, with no net-change in footprint. With this, it is unlikely that the project would have any adverse impact to turtle over-wintering activity.

Activities extending beyond re-watering are anticipated to be solely terrestrial-based and above the high-water mark, in the dry. However, depending on the scheduling and water levels at the time of construction (i.e. navigation season), low-scale near-water works may be required. Should this be the case, appropriate measures shall be erected in place, to isolate and contain the work area from impacting the waterway.

Furthermore, as there are no permanent changes or habitat loss due to the work, and there are no critically important landscape features such as highly-specialized or rare nesting and over-wintering habitat within the project area, it can be assured that there are no significant adverse impacts to turtle species due to this project.

8.5.3. Insects:

Fielded areas containing mixtures of long-grasses and flowering and seeding plants are not uncommon to this area, so it is not anticipated that the planned disturbance to lawned areas within the project site will have any significant adverse impact upon the continuance of local butterfly populations.

Should a replantation plan be required, rehabilitation and replantation efforts should include the planation of Milkweed and butterfly-friendly flowers:

- Common Milkweed (*Asclepias syriaca*) – grows in well-drained soil;
- Butterfly Milkweed (*Asclepias tuberosa*) – grows in well-drained soil;
- Swamp Milkweed (*Asclepias incarnata*) – grows in damper, marshy areas;
- Purple Coneflower (*Echinacea purpurea*);
- Black-eyed Susan (*Rudbeckia hirta*); and
- Canada Goldenrod (*Soilidago canadensis*)

8.5.4. Mammals:

It is important to note that trees have not been assessed for bat roosting potential along the entire length of the project area. It is not likely that bat winter hibernation habitat occurs on site, or within areas to be impacted by the project. However, summer roost sites could be present under the loose bark of dead trees, the hollows of trees, or man-made structures.





Although some vegetation disturbance is anticipated as part of the project, this does not include the removal or disturbance of large trees.

Despite this possibility, as the area contains a wide mixture of vegetation, ranging from treed and scrubby areas to open, sparse and long-grassed areas, in addition to residential buildings and man-made structures, the impacted areas in question are not significant nor specialized. Much more viable and suitable habitat is widely available within proximity to the project area.

Furthermore, construction activities are scheduled between fall 2019 and winter 2019/2020, coinciding with timing for when bats would be occupying winter-hibernation habitat, and would thereby not be present on site or affected by ongoing site activities.

If required, as general due diligence, the removal of mature and snag trees (particularly all large Poplar, Maple, Oak and Pine) should be limited where feasible. Furthermore, if applicable, vegetation clearing should be restricted/limited between April 1st and July 31st.

8.5.5. Vegetation:

In June 2017, a species inventory survey was conducted of the construction footprint and determined that treed individuals within the area Butternut-potential are most likely Black Walnut (*Juglans nigra*). Tree removal is not anticipated to be warranted for this project. With this, it is not anticipated that any Butternut individuals will be impacted by the planned construction activities.

Should a Butternut individual be identified within the work area, the individual should be preserved (see **Section 9**). Alternatively, a compensation plans for the destruction of a SAR individual(s) shall be developed and a SAR permit should be sought.

8.6. Air Quality and Noise:

Use of diesel-powered machinery may result in temporary, localized effects on air quality around the project site. Noise from construction may be disruptive for local residences. However, these types of disturbances are temporary and with the appropriate mitigation measures in place, they are not foreseen to be a threat to local flora, fauna, and people. The project is expected to employ well-maintained heavy equipment and machinery, fitted with emission control systems, mufflers, exhaust baffles, engine covers, etc. All on-site vehicles are expected to have a Drive Clean Emissions Report in compliance with O. Reg. 361/98: Motor Vehicles under the Environmental Protection Act, R.S.O. 1990, c. E.19.

PCA will monitor public complaints and address any air quality/noise issues raised by the public. Key mitigation will be to conduct work during normal business hours in accordance with local noise bylaws and to inform local residents in advance of potential disruption from noisy activities.

8.7. Invasive Species:

Given that the project's activities are planned to occur on previously disturbed terrestrial areas, and that any near/in-water work is to be conducted in the dry, there is a limited potential to bring in new, or further spread presently existing invasive species as the contractor moves equipment into and out of the site. Appropriate mitigation measures will be applied to reduce the risk of moving invasive species by means of proper identification and documentation of species, taking precaution when





handling potentially contaminated/infested soils and vegetation, and effective cleaning of clothing, equipment and vehicles (see **Section 9** below).

8.8. Cultural Resources:

The TSW is a National Historic Site (NHS) owned and managed by PCA on behalf of all Canadians. PCA is committed to protecting and enhancing the TSW in a manner that ensures its long-term functionality, safety, cultural integrity and sustainability. TSW Conservation Guidelines pertaining to the heritage design considerations are provided by PCA. This guidance is meant primarily to ensure that new works promote the protection and conservation of the historic sites and that the TSW Vision and Commemorative Integrity is not compromised.

A complete assessment of potential adverse impacts to cultural resources, and mitigation and advice to employ in order to minimize/eliminate such effects, shall be provided in full by CRM within the CRIA document.

8.9. Archaeology:

Following implementation of archaeological mitigation measures (see **Section 9**), Impacts from construction activities, including staging areas and access roads, are deemed to not likely cause significant adverse impacts to known or potential archaeological resources. If significant archeological resources (i.e., Indigenous artifacts, structural remains and/or artifact concentrations) are encountered during construction, work will cease and PCA shall be contacted for advice and assessment of significance, which will in turn determine what will be required to mitigate impacts.

A complete assessment of potential adverse impacts to archaeological resources, and mitigation and advice to employ in order to minimize/eliminate such effects, shall be provided in full by PCA's Terrestrial Archaeology division within an AOA document.

8.10. Health and Safety:

A Health and Safety Plan will be submitted by the contractor to PCA for review and acceptance as part of the permitting agreement. The Canadian Occupational & Safety Regulations and all approved Parks Canada Safe Work Practices will be strictly adhered to during all stages of work perform, in order to ensure safety of staff and others at all times. Additionally, Health and safety measures must be taken according to the *Occupational Health and Safety Act* during decommissioning, and construction activities.

8.11. Other Environmental Considerations:

Extreme weather events, which may be no longer considered an uncommon occurrence, are a concern and must be factored into project planning and mitigation. Heavy rainfall will cause rivers and lakes to rise suddenly. Elevated water levels, large water volumes and high velocities are the result (see **Section 9.15**).

Possible adverse effects upon Valued Components will not be considered significant once the mitigation measures outlined in Section 9 of this document have been implemented.





9. MITIGATION MEASURES

To mitigate for the potential harmful effects of the project, the following measures shall be implemented:

9.1. General:

- 9.1.1.** Inform the Departmental Representative and PCA's Environmental Authority (EA) (Environmental Officer, TSW in Peterborough) regarding any changes to project plans and/or scheduling. Any changes not assessed under this Basic Impact Assessment (BIA) will require approval from PCA and may require further mitigation measures.
- 9.1.2.** Contractor is required to submit an Environmental Management Plan (EMP) to the Department Representative and Parks Canada Agency's Environmental Authority that outlines all the measures to be implemented by the contractor on the project site to eliminate or reduce environmental effects and address mitigation measures outlined in this BIA. In order to allow for the timely commencement of project activities, the EMP can be submitted as separate components as project details become available. The EMP, or its components, will be submitted in writing prior to implementation of project activities and must be accepted by Parks Canada and the Departmental Representative.
- 9.1.3.** It is recommended that an environmental professional(s) (EP) prepare the EMP or its component plans incorporating guidance found in PCA's Environmental Standards and Guidelines - Ontario Waterways (2017). The EMP will detail frequency of monitoring and list high-risk construction activities where an environmental professional must be onsite. Monitoring and testing should be adaptable to changing site conditions and will capture any event/incident for the length and scope of that event.
- 9.1.4.** The contractor is to ensure that all on-site personnel are aware of, and comply with the prescribed mitigation measures within this BIA and any measures outlined within subsequent amendments to this BIA.
- 9.1.5.** Should conditions at the work site indicate that there are negative impacts to fish, fish habitat, wildlife, cultural or visitor experience resources, all works shall cease until the problem has been corrected and PCA's ES staff have been consulted/notified. PCA has the right to require that work be altered or ceased immediately.
- 9.1.6.** As per the *Historic Canal Regulations (HCR)* applicable to lands administered by the Trent Severn Waterways National Historic Site of Canada, a permit signed by PCA's Ontario Waterways Director will be required to authorize the project work prior to commencement of the project.

9.2. Equipment and Site Condition:

- 9.2.1.** Maintain equipment and machinery to avoid leakage of fuels and liquids. Ensure measures are in place to minimize impacts of accidental spills.
- 9.2.2.** All materials and equipment used for the purpose of site preparation and project completion shall be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, debris etc.) from entering the water.





- 9.2.3.** Any stockpiled materials, or concrete debris shall be stored and stabilized a safe distance away from any watercourse, drainage course or swales to prevent erosion and subsequent entry into the TSW or removed from the site, in accordance with all federal, municipal and provincial regulations.
- 9.2.4.** Store all oils, lubricants, fuels and chemicals in secure areas on impermeable pads.
- 9.2.5.** Vehicle and equipment re-fueling and/or maintenance shall be conducted on a permeable pad to allow full containment of spill, off of slopes and away from the water at a recommended distance of 30 m if possible. If not possible, fueling sites shall be as per the EMP and mitigations to prevent substances from entering the watercourse applied.
- 9.2.6.** A designated re-fueling depot will minimize the potential for extensive impacts at the site due to accidental releases of substances; proper spill management equipment shall be in place for fueling.
- 9.2.7.** Drip trays shall be placed under all fuel-powered equipment. Drip trays shall be sized appropriately to encompass the outer perimeter of the equipment/machinery, providing adequate spacing for refueling activities.
- 9.2.8.** All compressed air/fuel tanks shall be stored off to the side, away from on-going activity, and be adequately protected with an impact-protection barrier.
- 9.2.9.** Any Above-ground Storage Tanks (ASTs) or other fuel storage tanks on site, are to be stored in compliance with Federal and Provincial storage tank requirements. Specifically ASTs are to be placed within a secondary containment system of adequate holding capacity, based on the volume of the AST. See: <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/code-practice-storage-tank-systems/part-3.html> .
- 9.2.10.** There shall be no discharge of chemicals and cleaning agents in or near aquatic habitats; all such substances shall be disposed of at a facility licensed to receive them
- 9.2.11.** Spill control and emergency plans will be in place prior to initiation of construction; an emergency spill kit shall be kept on-site and employed immediately should a spill occur. The contractor shall ensure that adequate additional spill clean-up resources are available.
- 9.2.12.** In the event of a spill, PCA and the Ontario Spill Action Centre (1-800-268-6060) shall be notified immediately. Remediation will be conducted immediately to contain and clean up in accordance with federal and provincial regulatory requirements **AND to the satisfaction of PCA**. Documentation of remediation, testing and results will be provided to PCA. Spills should be reported directly to the PCA Environmental Officer on file (705-750-4900).
- 9.2.13.** Operate machinery from stable location.
- 9.2.14.** Only the working end of machinery shall directly enter the water. Any part of a machine or equipment entering the water shall be free of fluid leaks and externally degreased to





prevent any deleterious material from entering the water. Complete the in-water activity as quickly as possible to minimize the time equipment is in the water. Do not leave equipment in water during breaks in work activity.

9.2.15. The use of biodegradable hydraulic fluids for machinery that will be working in or around the river is preferred.

9.2.16. The Material Safety Data Sheet (MSDS) of any unapproved substances to be utilized onsite (particularly that of substances to be in use in/adjacent to water) shall be provided to PCA EA for review and acceptance. MSDS information of known products to be utilized in/adjacent to water throughout the duration of the project should be incorporated as part of the EMP.

9.3. Water Quality:

9.3.1. Ontario Drinking Water Quality Guidelines cannot be exceeded (beyond parameters that currently exist) due to project activities.

9.3.2. Only washed and clean material free of fine particulate matter shall be placed in or near water where it has been previously planned and authorized.

9.3.3. Salt and other road chemicals should be properly stored in designated areas only, preferably in dry sheds to prevent infiltration of leachate to the water table and surface runoff.

9.3.4. Accumulated snow that may be contaminated with salt should be disposed of only at approved dumpsites or designated areas.

9.3.5. Snow containing salt or sand should never be dumped in, or allowed to melt and run off into watercourses.

9.3.6. Ensure that all construction debris is removed from the canal prior to rewatering. This may involve sweeping and hosing down the bottom of the lock. All wash water is to be collected and treated.

9.4. Fish and Fish Habitat:

9.4.1. If required, all in-water work should be started after June 30th and completed before May 1st to protect fish populations during their spawning and nursery periods. All works shall be completed in the dry. If required, this may be accomplished by de-watering the work area and diverting and/or pumping flows around cofferdams placed at the limits of the work area. If required, a de-watering Plan shall be submitted, as part of an EMP, to PCA for review and acceptance prior to any dewatering.

9.4.2. Should dewatering/in water work be required, fish shall be removed from the work area prior to complete dewatering and released alive downstream into the river.

9.4.2.1. PCA's EA shall be advised 24 hours prior to fish rescue.

9.4.2.2. Minimize the length of time fish are out of the water.

9.4.2.3. Use appropriate equipment to remove any stranded fish in the dewatered area. As water levels drop in the work area monitor the deeper pool areas where fish are





congregating. If safe to do so, seine nets or dip nets can be operated by field staff to remove the fish.

- 9.4.2.4. Contact PCA EA staff should there be any issues with fish removal.
 - 9.4.2.5. Any fish found within the dewatered cofferdam areas will be documented by species, counted and removed and placed downstream if found in the downstream cofferdam and upstream if found upstream.
 - 9.4.2.6. Round Gobies (*Neogobius melanostomus*) or other invasive species found during dewatering activities shall be euthanized humanely and not returned to the water system; this shall be reported to PCA.
 - 9.4.2.7. Sediment/turbidity curtains shall be deployed in a manner – e.g. moved in a direction from close to shore/structures outward – which prevents the entrapment of fish inside the curtain.
- 9.4.3. Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life will form the baseline for water and streambed quality (see <http://ceqg-rcqe.ccme.ca/en/index.html#void>).
- 9.4.4. Activities causing turbidity or release of sediment will comply with the CCME Guidelines on Total Particulate Matter (see <http://ceqg-rcqe.ccme.ca/download/en/217>).
- 9.4.5. The proponent is advised to abide by those mitigation measures and best management practices outlined within Fisheries and Oceans Canada's (DFO's) online guidance materials: Measures to Avoid Causing Harm to Fish and Fish Habitat (<http://www.dfo-mpo.gc.ca/pnw-pppe/measures-mesures/measures-mesures-eng.html>).
- 9.4.6. If dewatering is required, ensure that there is a fish screen that complies with DFO *Freshwater Intake End-of-Pipe Fish Screen* Guideline when pumping in fish-bearing water to prevent impingement or entrainment of fish.

9.4. **Erosion and Sediment Control:**

- 9.4.1. Mandatory submission – and acceptance by PCA – of an Erosion and Sediment Control Plan, as stand-alone or part of the EMP, demonstrating:
- 9.4.1.1. A focus on erosion control primarily and sediment control secondary;
 - 9.4.1.2. Erosion and sediment controls will be tailored to the type of sediment found onsite (e.g. if clay is present, additional controls are necessary).
 - 9.4.1.3. The area to be controlled. In addition to the construction site, it is necessary to identify adjacent areas that could be negatively impacted by construction activities;
 - 9.4.1.4. Drainage areas and patterns based on pre-construction topography and construction design;
 - 9.4.1.5. The EMP will have, as a principal to reduce the amount of sediment laden water produced, a focus on separating offsite and infiltrating water into the construction site from construction activities and sediment sources.
 - 9.4.1.6. How clean storm run-on will be diverted around the site and away from exposed areas;
 - 9.4.1.7. How sediment-laden run-off will be directed to detention or retention facilities on-site. Large drainage areas can produce a significant amount of run-off, resulting in a need for large detention or retention structures;
 - 9.4.1.8. Channels that are designed and constructed to the necessary design discharge;





- 9.4.1.9. Temporary and permanent erosion control needs for all drainage channels;
 - 9.4.1.10. Consideration of project schedule in selecting, designing and laying out environmental controls; and
 - 9.4.1.11. Consideration of seasonal requirements (for longer-term projects); select and design controls and practices for controlling erosion and sedimentation including shutdown periods.
 - 9.4.1.12. The EMP shall provide plans and mitigation for the installation and removal of any temporary structures (i.e. cofferdams, temporary bridges, etc.).
 - 9.4.1.13. The EMP shall include a Traffic Control Plan which shall include measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. This shall also include measures to minimize the amount of mud transported onto paved public roads by vehicles and/or runoff.
 - 9.4.1.14. Trees and vegetation that are required to be removed should be clearly identified within the EMP and justification of removal should be made clear.
 - 9.4.1.15. The EMP shall include a replantation plan which shall outline the replacement and compensation of trees and vegetation which have been removed/impacted.
 - 9.4.1.16. The EMP shall include a Waste Water Management Plan, identifying methods and procedures for management, treatment and discharge of waste waters.
- 9.4.2. Erosion and sediment control measures shall be implemented prior to work and maintained during the work phase, to prevent entry of sediment into the water where site access or other activities cause exposed soil. The following principles should be considered:
- 9.4.2.1. Diversions to limit run-on water;
 - 9.4.2.2. Reduction of erosional forces by surface water velocity reduction;
 - 9.4.2.3. Reduction of sediment development through sediment collection or anchoring;
 - 9.4.2.4. Sedimentation of mobilized sediments;
 - 9.4.2.5. Filtration of sediment-carrying flows;
 - 9.4.2.6. Collection of captured or contained sediments;
 - 9.4.2.7. Treatment of pH (hydronium and hydroxide).
- 9.4.3. The size of particles present in the sediment is a key consideration for selecting the appropriate sediment treatment option(s):
- 9.4.3.1. If the sediment consists primarily of gravel or sand, which are relatively large particles, a single treatment using a more basic technology, such as a sediment trap or sediment bag, may be adequate.
 - 9.4.3.2. If the sediment consists of silt and/or clay, which are relatively small particles, the effluent will most likely need a more advanced technology, such as a filter press or chemical treatment with anionic flocculent and a filtration method.
 - 9.4.3.3. If the sediment consists of a large spectrum of particle sizes, the water may need primary treatment to remove larger particles, followed by secondary treatment to remove finer particles.
- 9.4.4. If required, in-water work shall be performed in a manner that minimizes the disturbance of the watercourse bottom and dispersion of sediment.
- 9.4.5. Sediment control measures shall be implemented during any in-water work (should it be required) to control turbidity levels. Sediment/turbidity curtains, or other appropriate





measures, shall be implemented prior to any in-water work that may result in sedimentation. These shall remain in place until all suspended sediments have settled.

- 9.4.6.** Monitor water quality for unacceptable suspended sediment levels during in and near-water activities. Monitoring shall include the full scope and breadth of any incident.
- 9.4.7.** All erosion and sediment control measures shall be inspected daily to ensure they are functioning properly and are maintained and/or upgraded as required to prevent entry of sediment into the water.
- 9.4.8.** Environmental protection measures shall be checked after each extreme weather event.
- 9.4.9.** If sediment and erosion control measures are not functioning properly, no further work shall occur until the sediment and/or erosion problem is addressed.
- 9.4.10.** All disturbed areas of the work site shall be stabilized immediately and re-vegetated as soon as conditions allow. All exposed areas should be covered with erosion control blankets or other measures to keep the soil in place and prevent erosion until vegetated in the spring.
- 9.4.11.** Soils shall be protected by laying geotextile and covering with a suitable depth of gravel, >100mm to prevent crushing/compaction of existing soils; alternative methodology for soil-compaction prevention may be utilized (ex. blast mats), as reviewed and approved by PCA.
 - 9.4.11.1.** Laying of geotextile and gravel should not occur prior to the beginning of May (after 2 or more 15°C sunny days), once snakes have emerged from their hibernacula.
- 9.4.12.** Sediment and erosion control measures shall be left in place until all areas of the work site have been stabilized.
- 9.4.13.** Upon completion of the work all debris shall be completely removed and the area restored to its original state or better. Repair all damages to property due to project activities.
- 9.4.14.** Sediment control measures and exclusion fencing must be removed in a way that prevents the escape or re-suspension of sediments.
- 9.4.15.** Erosion and Sediment controls shall not be removed without acceptance from PCA.
- 9.4.16.** If utilized, turbidity curtains are to be anchored or weighted down across its length to form a continuous seal on the substrate bed, with adequate floatation at the water's surface to prevent over spills of water.
- 9.4.17.** If in-water works are required, turbidity curtains should not be used as a primary or secondary settling area for dewatering activities. Supplementary sediment and erosion control measures should be installed prior to construction activities and should be added upon/reinforced as necessary.
- 9.4.18.** No acid-generating rock (containing sulphides) will be used.





- 9.4.19.** In the event of a significant sedimentation or debris caused by construction activities, the contractor will take appropriate measures to contain and mitigate the problem including the installation of additional downstream turbidity curtains.
- 9.4.20.** The contractor will maintain a standby supply of pre-fabricated sediment fence barriers, or an equivalent ready-to install sediment control devices.
- 9.4.21.** Avoid activities that could lead to erosion during excessively wet weather conditions; monitor forecasts for heavy rainfall watches & warnings.

9.5. Concrete:

- 9.5.1.** Concrete leachate is alkaline and highly toxic to fish and aquatic life. Measures must be taken to prevent the incidence of concrete or concrete leachate from entering the watercourse. Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient air temperature is below 0°C or until significantly cured to allow the pH to reach neutral levels. Avoid project activity during wet weather conditions
- 9.5.2.** All concrete, sealants, or other compounds used for this project shall be utilized according to the appropriate Product Technical Data Sheet, stating guidelines and methods for proper use, and provided by the manufacturer of the product.
- 9.5.3.** Ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime-containing construction materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse.
- 9.5.4.** Concrete debris and dust generated as a result of various concrete work shall be removed in a way that will ensure material does not enter the waterway. All debris including unused aggregate/concrete rubble shall be completely removed and area restored to original state upon completion of work.
- 9.5.5.** Concrete debris shall be placed into an enclosed container daily, or more frequently if required, in order to ensure that no debris escape or remain at the site.
- 9.5.6.** Any concrete wash water shall be directed to an isolated/impermeable containment unit and treated to effectively remove all suspended solids, neutralize pH impacted water, and to prevent deleterious substances from entering the watercourse.
- 9.5.7.** Should dewatering be required, at the discharge point into the watercourse, pH will be maintained between 6.5 and 9.0. Water with pH > 9 cannot be released directly back into the watercourse, but must be treated prior to release. Water with a pH ≥ 12.5 is considered toxic and treated as a hazardous waste under Ontario Regulation 347 of the *Environmental Protection Act* and wastewater in this condition must be removed from the site.





9.5.8. In the event of sedimentation or turbidity caused by construction activity, contractor shall stop all work and install additional sediment barriers as necessary to ensure watercourse is protected.

9.5.9. Mitigation Measures For Placement Of Tremie Concrete (should it be required):

9.5.9.1. Ensure concrete forms are tight and no flow is occurring.

9.5.9.2. Isolate area with curtain or impermeable material specified for concrete particulates; ensure fish exclusion is followed.

9.5.9.3. Isolated area should be the minimum size required to complete task.

9.5.9.4. For tremie pours, CO₂ system must be installed and operating along the entire length of the isolated area. The tank shall be used to release carbon dioxide gas into an affected area to neutralize pH levels. Ensure sufficiently sized tanks for the concrete volumes used.

9.5.9.5. Workers shall be trained in the use of the system.

9.5.9.6. Use of neutralizing acids is not permitted.

9.5.9.7. pH monitoring conducted inside and outside the containment area, and downstream while the activity is taking place. Monitoring locations and frequency shall be outlined within the EMP

9.5.10. In the event of a release of concrete or grout, PCA and the Ontario Spill Action Centre (1-800-268-6060) shall be notified; remediation will be conducted immediately contain and clean up in accordance with federal and provincial regulatory requirements **AND to the satisfaction of PCA**. Documentation of remediation, testing and results will be provided to Parks Canada.

9.5.11. Wash equipment away from water and provide containment facilities for the wash-down water from concrete delivery trucks (if applicable), concrete pumping equipment, and other tools and equipment. Wash-out locations will be identified within the EMP.

9.6. Dewatering and Pumping Activities (If required):

9.6.1. Discharged water should be filtered by means of an appropriately designed sediment basin, anionic flocculation or by physical means such as a filter press.

9.6.2. Discharge of pumped water must be a manner that does not cause additional erosion.

9.6.3. Dewatering, demolition and construction is staged such that clean is pumped back to the system and turbid water is managed through a waste water system.

9.7. Vegetation:

9.7.1. In compliance with the *Migratory Bird Convention Act (MBCA)*, no removal of trees or other vegetation during the breeding bird window from April 1st to August 31st is to take place of any year.

9.7.2. Where it is necessary to remove mature vegetation at any time of year, an inventory of species to be removed, coupled with a replanting plan using native species shall be submitted to PCA staff for approval.





- 9.7.3.** Trees (and associated root systems), shrubs and vegetation which are to remain throughout construction should be properly identified and delineated with flagging tape or temporary fences.
- 9.7.4.** Where practical, the branches of the large trees should be trimmed back as the first option rather than cutting the entire tree.
- 9.7.5.** Whenever possible, vegetation should be trimmed in early spring, late fall or winter. Trimming when the plant is actively growing (i.e. late spring summer and early fall) can further stimulate growth, weakening the plant and making it susceptible to disease.
- 9.7.6.** Ensure appropriate handling procedures are followed for noxious weeds such as Giant Hogweed (*Heracleum mantegazzianum*), Poison Ivy (*Toxicodendron radicans*) or Wild Parsnip (*Pastinaca sativa*).
- 9.7.7.** In disturbed areas not designated for sodding, native species are to be used for tree planting and/or ground cover with mulch to prevent erosion and to help seeds germinate.
- 9.7.8.** In the event that the installation of root-protectant fencing is not possible and/or ideal, alternative measures, as approved by PCA, must then be implemented. Such measures must provide a sufficient amount of soil compaction prevention with regards to the highest level of activity to occur within the immediate area of protection.

9.8. Wildlife:

- 9.8.1.** If a turtle is found within the limits of the fencing it should be left alone to leave the area if possible. If found in the project area, turtles may need to be relocated prior to commencing work (with permits required from Ontario Ministry of Natural Resources and Forestry (OMNRF) for relocation). Contact PCA for guidance
- 9.8.2.** The EMP must detail procedures (e.g. exclusion fencing) for preventing turtle entry/nesting within disturbed project gravels/soils during all stages of project activity.
- 9.8.3.** Once cleared and before staging set-up, temporary reptile fencing, such as polythene/ woven geotextile secured with timber stakes, or material of a similar nature/function, should be installed completely around gravel stockpiles to prevent turtle nesting in the project area. Exclusion fencing should also be installed completely around stockpiled material (wood chips, gravel, earth, etc.) to prevent turtle nesting in the project area. Fencing shall not have mesh or netted backing. For guidance on how to plan and install exclusion fencing, refer to the document titled Species at Risk Branch, Best Practices Technical Note, Reptile and Amphibian Fencing, Ver. 1.1, developed by the Ontario Ministry of Natural Resources and Forestry: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_tx_rptl_amp_fnc_en.pdf
- 9.8.4.** The EMP must demonstrate procedures for avoiding disturbance/harm to wildlife and nesting birds.





- 9.8.5. Synthetic plastic Erosion Control Blankets/Mats should not be utilized, particularly during nesting season, as they pose as an entrapment hazard to turtles. Fibre-based bio-degradable Erosion Control Blankets/Mats are only to be utilized.
- 9.8.6. If recommended by an environmental professional and approved by PCA, exclusion zones or “no go” areas will be established to protect areas with known residences (e.g., hibernacula, dens, nests).
- 9.8.7. Field information regarding incidental encounters with wildlife (non-SAR wildlife) shall be compiled and reported on a daily basis.
- 9.8.8. For incidental encounters, the following information should be recorded in the field:
 - 9.8.8.1. Locations, dates and time of day where the species were encountered;
 - 9.8.8.2. Names of species encountered;
 - 9.8.8.3. Photographs of the species, if taken;
 - 9.8.8.4. Condition of animal.
- 9.8.12. If injured/dead wildlife are encountered report to PCA immediately. PCA may require retrieval and storage on ice of carcass for laboratory testing
- 9.8.13. The contractor shall ensure that all vehicles and equipment used by project personnel will follow any construction zone speed limits to reduce the risk of hitting wildlife, as enforced by the site supervisor.
- 9.8.14. Work areas will be kept clean and free of potential hazards to wildlife such as wire, cable, tubing, plastic, antifreeze or other materials that wildlife may eat or become entangled in.
- 9.8.15. Waste will be stored, handled, and transported in accordance with the Waste Management Plan, including storage of all solid waste in sealed, bear-proof containers.
- 9.8.16. Feeding of wildlife is prohibited.
- 9.8.17. Attractants (i.e. waste) shall be regularly removed from site to further deter the presence of wildlife in the work area.

9.9. Species At Risk:

- 9.9.1. The contractor is to ensure that species at risk training is provided to all employees before they begin work on site (materials can be part of the Environmental Protection Plan). Employees must be able to identify potential species at risk and know the proper procedures to follow when they encounter a species at risk.
- 9.9.2. If a Species at Risk is observed or suspected on or near the worksite (this includes snakes, turtles and/or eggs), the species must not be harmed or harassed. If the species does not leave or cannot leave the site, the contractor must immediately stop the works and contact PCA’s EA staff on how to proceed. Additional measures to avoid impacts may be required before work can restart. Stand back and allow the animal to leave the site.





- 9.9.3. Prior to construction and the beginning of nesting activity (May 1st), an inspection for Barn Swallow and Chimney Swift nests within the construction area shall be conducted by an Environmental Professional. Should empty nest structures be observed at this time, they should be reported to PCA and further mitigation measures may be required. Deterrent mitigations to prevent further nesting activity throughout the life of project activities in affected areas must be included in the EMP.
- 9.9.4. After May 1st, daily inspections of the bridge structure for bird nesting attempts and removal of preliminary nest structures (i.e. initial deposition of nest-building material by breeding birds) shall be completed.
- 9.9.5. Minimize the disturbed area; clearly mark the work space.
- 9.9.6. Park on roads or disturbed area only.
- 9.9.7. Rehabilitation and replantation efforts should include the planation of milkweed and butterfly-friendly flowers.

By following these specific mitigation measures, the federal Species at Risk Act (SARA) and the provincial Endangered Species Act (ESA) will not be contravened.

9.10. Invasive Species:

- 9.10.1. To reduce the risk of introducing invasive species, all equipment, clothing and footwear must be thoroughly cleaned prior to coming to the site. Any machinery that appears to have not been cleaned will not be permitted on site. For additional information or guidance on how to properly clean equipment, see the Clean Equipment Protocol for Industry developed by the Ontario Invasive Plant Council and found here:
http://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/07/Clean-Equipment-Protocol_June2016_D3_WEB-1.pdf
- 9.10.2. If applicable, any equipment or vehicles which are to be used in water, should be thoroughly cleaned before and after use of any visible mud, vegetation, mussels, etc.
- 9.10.3. Should an invasive species be encountered (or at least suspected), a photo and report of the specimen should be sent to PCA's EA staff and the Invading Species Hotline at 1-800-563-7711 or online at EDDMapS Ontario:
<https://www.eddmaps.org/ontario/>.
- 9.10.4. Use weed-free material (i.e. sand, gravel, etc.) for erosion control and stabilization and weed-free seed and confirm that seed mix to be used for revegetation purposes does not (potentially) contain invasive plants.
- 9.10.5. Seed purchased commercially should have a label that states the following:
 - 9.10.5.1. Species;
 - 9.10.5.2. Purity: Most seed should be no less than 75 % pure and preferably over 85 % pure. The rest is inert matter or other seed;
 - 9.10.5.3. Weed seed content: The tag should state NO invasive plants are present. Only certified weed-free seed should be used; and





- 9.10.5.4.** Germination of desired seed: Germination generally should not be less than 50 % for most species, although some shrubs and forbs will have lower percentages.
- 9.10.6.** Move only weed/contaminate-free materials into non-infested areas. Moving materials from one infested location to another within a particular zone may not cause contamination, but moving materials from infested to non-infested areas could lead to the introduction and spread of invasive plants.
- 9.10.7.** If removal of invasive species occurs, individuals will be disposed of appropriately, offsite to ensure no further propagation.
- 9.10.8.** Workers should familiarize themselves with invasive species potentially present within the work site areas:
- 9.10.8.1. Black Locust:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3350>
 - 9.10.8.2. Boxelder:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3245>
 - 9.10.8.3. Chinese Mysterysnail:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=59309>
 - 9.10.8.4. Coltsfoot:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=6564>
 - 9.10.8.5. Common Periwinkle:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3081>
 - 9.10.8.6. Dames Rocket:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=5702>
 - 9.10.8.7. Dog-strangling Vine:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=4260>
 - 9.10.8.8. European Buckthorn:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3070>
 - 9.10.8.9. European Common Reed:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=59038>
 - 9.10.8.10. European Frog-bit:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=12792>
 - 9.10.8.11. Garlic Mustard:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3005>
 - 9.10.8.12. Giant Hogweed:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=4536>
 - 9.10.8.13. Japanese Knotweed:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=19655>
 - 9.10.8.14. Multiflora Rose:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3071>
 - 9.10.8.15. Norway Maple:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3002>
 - 9.10.8.16. Purple Loosestrife:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3047>
 - 9.10.8.17. Round Goby:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=12252>
 - 9.10.8.18. Rusty Crayfish:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=15170>
 - 9.10.8.19. Scots Pine:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3231>





- 9.10.8.20. Tatarian Honeysuckle:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=3043>
- 9.10.8.21. Wild Parsnip:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=6147>
- 9.10.8.22. Yellow Iris:** <http://www.eddmaps.org/ontario/Species/subject.cfm?sub=5853>
- 9.10.8.23. Yellow Sweet-clover:**
<http://www.eddmaps.org/ontario/Species/subject.cfm?sub=6008>
- 9.10.8.24. Zebra Mussel:**
<http://www.eddmaps.org/ontario/species/subject.cfm?sub=10567>
- 9.11. Cultural Resources and Archaeology:**
- 9.11.1.** Before any on-site mobilisation/construction work commences, PCA staff will clearly delineate any archaeologically sensitive areas and photo-document this activity for PCA records. These areas will be deemed no-go zones for staging, vehicular traffic and machinery.
- 9.11.2.** The contractor is to ensure that all personnel working on site undergo a heritage induction to clearly identify the value of the place and how to avoid inadvertent impacts on cultural and archeological resources (known and unknown).
- 9.11.3.** Vehicular access routes and staging areas will be restricted to present-day roadways, parking lots, exposed bedrock areas and significantly disturbed areas. If this is not possible, the use of protective covering is required. All protective measures employed must be removed following construction and the area restored to a pre-construction state. Excavation is not permitted outside of cleared/reviewed areas in the AOA during installation or removal of protective covering.
- 9.11.4.** If archaeological, cultural resources, or character-defining elements (e.g. structural features or artifact concentrations) are encountered or damaged during construction activities, work will cease in the immediate area and the PCA PM shall be informed. The PM should then contact PCA's Terrestrial Archaeology section for advice and assessment of significance, and if necessary, any further mitigation measures. Ensure that all exposed underwater cultural materials are kept submerged and/or wet while waiting direction.
- 9.11.5.** Inform the CRM Advisor, Ontario Waterway regarding any changes to project plans and/or scheduling. Any changes not assessed under this BIA will require approval from PCA and may require further mitigation measures.
- 9.12. Air Quality and Noise:**
- 9.12.1.** All on-site vehicles are expected to have a Drive Clean Emissions Report in compliance with O. Reg. 361/98: Motor Vehicles under the Environmental Protection Act, R.S.O. 1990, c. E.19. EA Officers may stop a vehicle if they believe the vehicle is emitting excessive exhaust smoke or suspect that emission control equipment has been tampered with or removed.
- 9.12.2.** Use well-maintained heavy equipment and machinery, preferably fitted with fully functional emission control systems/muffler/exhaust baffles, engine covers, etc. In addition, employ timing and location of construction activities to reduce or minimize the effect of noise on nearby residents, recreational users, and wildlife.





9.12.3. Machines shall not be left to unnecessarily idle in order to avoid emissions.

9.12.4. Adhere to local and municipal noise by-laws.

9.12.5. Notify residents of planned activities that may cause disturbance and schedule them to avoid sensitive time periods.

9.13. Waste Disposal:

9.13.1. Recyclable material and waste shall be removed from the site, in accordance with all federal, provincial and municipal regulations, to disposal facilities licensed to receive them.

9.13.2. Waste containers should be sealed or lined to prevent leakage of liquid wastes.

9.13.3. Waste generated will be disposed according to regulations (i.e., O. Reg. 102/94 and O. Reg. 558/00, R.R.O. 1990, 347).

9.14. Work Area Commissioning:

9.14.1. If applicable, ensure that all construction debris is removed from the work area prior to rewatering. This may involve sweeping and hosing down the bottom of work area. All wash water is to be collected and treated.

9.15. Floods, Extreme or Inclement Weather, and Ice Formation:

9.15.1. Undertake construction under normal weather conditions, to the extent possible, and design the project worksite to withstand variable weather conditions.

9.15.2. Apply wet weather restrictions on construction activities to reduce surface run-off from exposed work areas and to minimize the risk of inundation.

9.15.3. The work area shall be stabilized against the impacts of high flow/heavy rainfall events at the end of each workday.

9.15.4. Work shall be suspended and the work area stabilized when there is a high probability of a rainfall event.

10. PUBLIC/STAKEHOLDER ENGAGEMENT & ABORIGINAL CONSULTATION

- Indicate whether public/stakeholder engagement was undertaken in relation to potential adverse effects of the proposed project:
 - No
 - Yes

- Indicate whether Aboriginal consultation was undertaken in relation to potential adverse effects of the proposed project:
 - No
 - Yes





Comments: Parks Canada is engaged with Williams Treaties First Nations (WTFN) in ensuring Aboriginal and Treaty Rights issues are properly addressed and where warranted accommodation made on all projects and activities within the Trent Severn Waterways under the management of Parks Canada. Given the nature of the works (maintenance of an existing structure), with the appropriate mitigation measures in place, and taking into account engagement on similar matters to date specific Aboriginal Consultation was not undertaken. WTFN communities will be updated regularly on the status of the project and if needed further engagement may be undertaken.

11. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

Activities for this project are terrestrial based, with no planned vegetation removal and minimal vegetation disturbance. Near-water works and activities are anticipated to be executed in the dry during non-navigation dewatered conditions. Concrete work is expected to be minimal.

Furthermore, this area are not considered specialized, nor sensitive in nature, and vegetation and landscape in-kind can be found elsewhere within close proximity of the work area. Residual effects resultant of this disturbance is not anticipated to be significantly adverse to those valued environmental component assessed above.

Overall, the project may be considered low-impact and low-risk.

With implementation of project mitigation, no significant residual adverse effects and/or adverse effects on ecological integrity (EI), commemorative integrity (CI), and visitor experience (VE) objectives are anticipated.

12. SURVEILLANCE

- Surveillance is not required
- Surveillance is required
- Required in accordance with the *Parks Canada Cultural Resource Management Policy*

Parks Canada's Environmental Authority will visit the site regularly during construction to ensure that mitigation measures are in place, working as anticipated and are effective at preventing adverse effects to natural and cultural heritage features.

Surveillance by Cultural Resource Management Staff is also recommended to ensure effectiveness of proposed mitigation measures.

13. FOLLOW-UP MONITORING

Follow-up monitoring is:

- Not required
- Legally required (e.g. under the *Species at Risk Act* or *Fisheries Act*)
- Required in accordance with the *Parks Canada Cultural Resource Management Policy*





14. SARA NOTIFICATION

Notification is:

- Not required
- Required under the *Species at Risk Act* (outline the nature of and response to any notification).

The activity will not lead to residual adverse effects that contravene a SARA prohibition for a listed species at risk, its residence or its Critical Habitat.

15. EXPERTS CONSULTED

Department/Agency/Institution: Parks Canada Agency	Date of Request: June 21 th , 2018
Expert's Name & Contact Information: Wesley Little	Title: Project Engineer, Trent Severn Waterway
Expertise Requested: Project overview and construction process details	
Response: Project Documents and details provided	

16. DECISION




Taking into account implementation of mitigation measures the project is:

- Not likely to cause significant adverse environmental effects.
- Likely to cause significant adverse environmental effects.

FOR SARA REQUIREMENTS:

- There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

17. RECOMMENDATION AND APPROVAL

Prepared by (EIA Author): Sarah Bunting, Environmental Assessment Officer	Date: April 11 th 2019
Signature: 	
Recommended by: Valerie Minelga, Environmental Assessment Scientist	Date: 2019/04/11
Signature: 	
Approved by (Director of Ontario Waterways): Jewel Cunningham, Director, Ontario Waterways	Date: APR 12 2019
Signature: 	





18. REFERENCES

Angler's Atlas (AA). <https://www.anglersatlas.com> , Accessed August 1st, 2018.

ARCADIS, Fish Habitat Assessment of Various Sites long the Trent Severn Waterway (TSW) and the Rideau Canal Waterway (RCW) – 19. Warsaw Road Swing Bridge, March 2017.

Atlas of Breeding Birds of Ontario (OBBA). <https://www.birdsontario.org/atlas/index.jsp> , Accessed August 1st, 2018.

Early Detection and Distribution Mapping System (EDDMapS) Ontario. <https://www.eddmaps.org/ontario/> , Accessed August 1st, 2018.

Ontario Ministry of Energy, Northern Development and Mines. Ontario Geological Survey <http://www.mndm.gov.on.ca> , Accessed August 1st, 2018.

Ontario Reptile and Amphibian Atlas (ORAA). <https://ontarionature.org/oraa/maps/> , Accessed August 1st, 2018.

19. ATTACHMENTS

Appendix A: Warsaw Swing Bridge 27 - Site Photos

Appendix B: Warsaw Swing Bridge 27 – Replacement – Construction Drawings 99% - 2018-09-21

Appendix C: Species Index for Warsaw Bridge and Surrounding Area

20. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

- Project registered in [tracking system](#)
- Not yet registered (*CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting.*)

*****Ensure that all required mitigation measures and conditions (e.g. follow-up monitoring requirements) are included in project permits and authorizations*****





Appendix A: Warsaw Swing Bridge 27 - Site Photos



Photo 1: Eastern bank upstream of Warsaw Bridge and Guard Gate which may be utilized by Turtles for nesting/access in spring. Photo taken north of bridge on eastern bank, facing north. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.



Photo 2: Current landscape and vegetation upstream (north) of bridge and guard gate on western bank. Photo taken north of bridge on eastern bank, facing west. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.





Photo 3: Typical landscape and vegetation upstream (north) of bridge on eastern bank. Photo taken north of bridge on eastern bank, facing south. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.



Photo 4: Typical landscape and vegetation upstream (north) of bridge on western bank. Photo taken north of bridge on eastern bank, facing west. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.





Photo 5: Overgrown grass and scrub vegetation presently downstream (south) on eastern bank of Warsaw Bridge. Photo taken south of bridge on eastern bank, facing north. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.



Photo 6: Overgrown grass and scrub vegetation presently downstream (south) on western bank of Warsaw Bridge. Photo taken south of bridge on eastern bank, facing west. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.





Photo 7: Typical landscape and vegetation of Warsaw Bridge area. Photo taken on the Warsaw Bridge, facing north (upstream). Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.

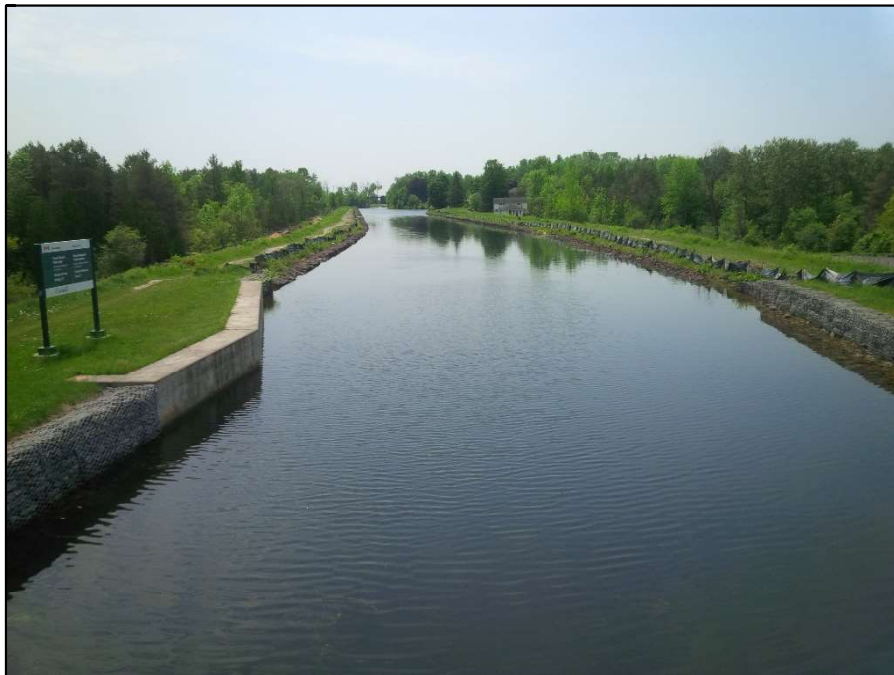


Photo 8: Typical landscape and vegetation of Warsaw Bridge area. Photo taken on the Warsaw Bridge, facing south (downstream). Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.





Photo 9: Overgrown grass and scrub vegetation presently downstream (south) on western bank of Warsaw Bridge. Photo taken south of bridge on western bank, facing north. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.



Photo 10: Typical landscape and vegetation adjacent to Lockmaster's Control Building. Photo taken on the Warsaw Bridge, facing north. Photo taken by Environmental Officer, Sarah Bunting May 30th, 2018.





Photo 11: Typical winter/non-navigation season's water levels of Warsaw Bridge. Photo taken upstream (north) of Warsaw Bridge and Guard Gate, facing south. Photo taken by Environmental Officer, Sarah Bunting November 5th, 2018.



Photo 12: Typical winter/non-navigation season's water levels of Warsaw Bridge. Photo taken upstream (north) of Warsaw Bridge, facing north. Photo taken by Environmental Officer, Sarah Bunting November 5th, 2018.





Photo 13: Typical winter/non-navigation season's water levels of Warsaw Bridge. Photo taken upstream (north) of Warsaw Bridge, facing south. Photo taken by Environmental Officer, Sarah Bunting November 5th, 2018.



Photo 14: Typical winter/non-navigation season's water levels of Warsaw Bridge. Photo taken downstream (south) of Warsaw Bridge, facing north. Photo taken by Environmental Officer, Sarah Bunting November 5th, 2018.





Photo 15: Typical winter/non-navigation season's water levels of Warsaw Bridge. Photo taken downstream (south) of Warsaw Bridge, facing south. Photo taken by Environmental Officer, Sarah Bunting November 5th, 2018.





Appendix B: Warsaw Swing Bridge 27 – Replacement – Construction Drawings 99% - 2018-09-21





Appendix C: Species Index for Warsaw Bridge and Surrounding Area

The following table is a compilation of aquatic and terrestrial wildlife and vegetation species which have been recorded to be observed, or are reported to possibly reside, at the Warsaw Bridge and within the surrounding area.

Common Name	Scientific Name	Sp. Note	Source
<u>ANIMALS</u>			
BIRDS			
Alder Flycatcher	<i>Empidonax alhorum</i>		ABBO
American Bittern	<i>Botaurus lentiginosus</i>		ABBO
American Crow	<i>Corvus brachyrhynchos</i>		ABBO, EB
American Goldfinch	<i>Spinus tristis</i>		ABBO, EB
American Kestrel	<i>Falco sparverius</i>		ABBO
American Redstart	<i>Setophaga ruticilla</i>		ABBO, EB
American Robin	<i>Turdus migratorius</i>		2018-06 SV, ABBO, EB
American Wigeon	<i>Anas americana</i>		EB
American Woodcock	<i>Scolopax minor</i>		ABBO, EB
Baltimore Oriole	<i>Icterus galbula</i>		ABBO, EB
Bank Swallow	<i>Riparia</i>	SAR	ABBO, EB, NHIC
Barn Swallow	<i>Hirundo rustica</i>	SAR	ABBO, EB, NHIC
Belted Kingfisher	<i>Megaceryle alcyon</i>		ABBO, EB
Black Tern	<i>Chlidonias niger</i>	SAR	ABBO
Black-and-white Warbler	<i>Mniotilta varia</i>		ABBO, EB
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>		ABBO
Blackburnian Warbler	<i>Setophaga fusca</i>		ABBO, EB
Black-capped Chickadee	<i>Poecile atricapillus</i>		2017-06 SV, ABBO, EB
Black-throated Blue Warbler	<i>Setophaga caerulescens</i>		EB
Black-throated Green Warbler	<i>Setophaga virens</i>		ABBO, EB
Blackpoll Warbler	<i>Setophaga striata</i>		EB
Blue Jay	<i>Cyanocitta cristata</i>		ABBO, EB
Blue-headed Vireo	<i>Vireo solitarius</i>		ABBO, EB
Blue-winged Teal	<i>Anas discors</i>		ABBO
Bobolink	<i>Dolichonyx oryzivorus</i>	SAR	ABBO, EB, NHIC
Brown Creeper	<i>Certhia americana</i>		ABBO
Brown-headed Cowbird	<i>Molothrus ater</i>		2018-06 2018, EB, PCA
Brown Thrasher	<i>Toxostoma rufum</i>		ABBO
Canada Goose	<i>Branta canadensis</i>		2017-06 SV, ABBO, EB
Canada Warbler	<i>Cardellina canadensis</i>	SAR	ABBO
Cape May Warbler	<i>Setophaga tigrina</i>		EB
Carolina Wren	<i>Thryothorus ludovicianus</i>		ABBO
Caspian Tern	<i>Hydroprogne caspia</i>		EB





Cedar Waxwing	<i>Bombycilla cedrorum</i>		ABBO, EB
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>		ABBO, EB
Chimney Swift	<i>Chaetura pelagica</i>	SAR	EB, NHIC
Chipping Sparrow	<i>Spizella passerina</i>		ABBO, EB
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>		ABBO
Common Gallinule	<i>Gallinula galeata</i>		ABBO
Common Grackle	<i>Quiscalus quiscula</i>		2017-06 SV, 2018-06 SV, ABBO, EB
Common Loon	<i>Gavia immer</i>		ABBO, EB
Common Merganser	<i>Mergus merganser</i>		ABBO
Common Raven	<i>Corvus corax</i>		EB
Common Snipe	<i>Gallinago</i>		ABBO
Common Yellowthroat	<i>Geothlypis trichas</i>		ABBO, EB, PCA
Cooper's Hawk	<i>Accipiter cooperii</i>		ABBO, EB
Dark-eyed Junco	<i>Junco hyemalis</i>		EB
Downy Woodpecker	<i>Picoides pubescens</i>		ABBO, EB
Eastern Bluebird	<i>Sialia sialis</i>		ABBO
Eastern Kingbird	<i>Tyrannus</i>		ABBO, EB
Eastern Meadowlark	<i>Sturnella magna</i>	SAR	ABBO, NHIC
Eastern Phoebe	<i>Sayornis phoebe</i>		ABBO, EB
Eastern Screech Owl	<i>Megascops asio</i>		EB
Eastern Towhee	<i>Pipilo erythrophthalmus</i>		EB
Eastern Wood-pewee	<i>Contopus virens</i>	SAR	ABBO, EB, NHIC
European Starling	<i>Sturnus vulgaris</i>	INV	ABBO, EB
Field Sparrow	<i>Spizella pusilla</i>		ABBO
Golden-crowned Kinglet	<i>Regulus satrapa</i>		EB
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	SAR	ABBO
Gray Catbird	<i>Dumetella carolinensis</i>		2017-06 SV, ABBO, EB
Great Blue Heron	<i>Ardea herodias</i>		2017-06 SV, EB
Great Crested Flycatcher	<i>Myiarchus crinitus</i>		ABBO, EB
Great Horned Owl	<i>Bubo virginianus</i>		ABBO
Green Heron	<i>Butorides virescens</i>		ABBO
Green-winged Teal	<i>Anas carolinensis</i>		ABBO
Hairy Woodpecker	<i>Leuconotopicus villosus</i>		ABBO, EB
Hermit Thrush	<i>Catharus guttatus</i>		EB
Hooded Merganser	<i>Lophodytes cucullatus</i>		EB
Horned Lark	<i>Eremophila alpestris</i>		ABBO
House Finch	<i>Haemorhous mexicanus</i>		ABBO, EB
House Sparrow	<i>Passer domesticus</i>		ABBO, EB
House Wren	<i>Troglodytes aedon</i>		ABBO, EB
Indigo Bunting	<i>Passerina cyanea</i>		ABBO
Killdeer	<i>Charadrius vociferus</i>		ABBO
Least Bittern	<i>Ixobrychus exilis</i>	SAR	ABBO, NHIC, SFO
Least Flycatcher	<i>Empidonax minimus</i>		ABBO, EB





Mallard	<i>Anas platyrhynchos</i>		2017-06 SV, 2018-06 SV, ABBO, EB
Marsh Wren	<i>Cistothorus palustris</i>		ABBO
Merlin	<i>Falco columbarius</i>		ABBO, EB
Mourning Dove	<i>Zenaida macroura</i>		2017-06 SV, ABBO, EB
Mourning Warbler	<i>Geothlypis philadelphia</i>		ABBO, EB
Nashville Warbler	<i>Leiothlypis ruficapilla</i>		ABBO, EB
Northern Cardinal	<i>Cardinalis</i>		2018-06 SV, ABBO, EB
Northern Flicker	<i>Colaptes auratus</i>		ABBO, EB
Northern Harrier	<i>Circus cyaneus</i>		ABBO, EB
Northern Parula	<i>Setophaga americana</i>		EB
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>		ABBO
Northern Waterthrush	<i>Parkesia noveboracensis</i>		ABBO
Osprey	<i>Pandion haliaetus</i>		ABBO, EB
Ovenbird	<i>Seiurus aurocapilla</i>		ABBO, EB
Palm Warbler	<i>Setophaga palmarum</i>		EB
Pied-billed Grebe	<i>Podilymbus podiceps</i>		ABBO
Pileated Woodpecker	<i>Hylatomus pileatus</i>		ABBO, EB
Pine Siskin	<i>Spinus pinus</i>		ABBO, EB
Pine Warbler	<i>Setophaga pinus</i>		ABBO
Purple Finch	<i>Haemorhous purpureus</i>		ABBO, EB
Purple Martin	Population stable		ABBO
Red-breasted Nuthatch	<i>Sitta canadensis</i>		ABBO, EB
Red-eyed Vireo	<i>Vireo olivaceus</i>		ABBO, EB
Red-tailed Hawk	<i>Buteo jamaicensis</i>		ABBO, EB
Red-winged Blackbird	<i>Agelaius phoeniceus</i>		ABBO, EB, PCA
Ring-billed Gull	<i>Larus delawarensis</i>		EB
Rock Pigeon	<i>Columba livia</i>		2018-06 SV, ABBO, EB
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>		ABBO, EB
Ruby-crowned Kinglet	<i>Regulus calendula</i>		EB
Ruby-throated Hummingbird	<i>Archilochus colubris</i>		ABBO, EB
Ruffed Grouse	<i>Bonasa umbellus</i>		ABBO, EB
Rusty Blackbird	<i>Euphagus carolinus</i>	SAR	EB
Savannah Sparrow	<i>Passerculus sandwichensis</i>		ABBO
Scarlet Tanager	<i>Piranga olivacea</i>		ABBO
Sedge Wren	<i>Cistothorus stellaris</i>		ABBO
Sharp-shinned Hawk	<i>Accipiter striatus</i>		ABBO
Solitary Sandpiper	<i>Tringa solitaria</i>		EB
Song Sparrow	<i>Melospiza melodia</i>		ABBO, EB
Sora	<i>Porzana carolina</i>		ABBO
Spotted Sandpiper	<i>Actitis macularius</i>		ABBO, EB
Swamp Sparrow	<i>Melospiza georgiana</i>		ABBO, EB





Tree Swallow	<i>Tachycineta bicolor</i>		ABBO, EB
Turkey Vulture	<i>Cathartes aura</i>		ABBO, EB
Upland Sandpiper	<i>Bartramia longicauda</i>		ABBO
Veery	<i>Catharus fuscescens</i>		ABBO
Vesper Sparrow	<i>Pooecetes gramineus</i>		ABBO
Virginia Rail	<i>Rallus limicola</i>		ABBO
Warbling Vireo	<i>Vireo gilvus</i>		ABBO, EB
White-breasted Nuthatch	<i>Sitta carolinensis</i>		ABBO, EB
White-throated Sparrow	<i>Zonotrichia albicollis</i>		ABBO, EB
Wild Turkey	<i>Meleagris gallopavo</i>		ABBO
Willow Flycatcher	<i>Empidonax traillii</i>		ABBO
Wilson's Warbler	<i>Cardellina pusilla</i>		EB
Winter Wren	<i>Troglodytes hiemalis</i>		ABBO, EB
Wood Duck	<i>Aix sponsa</i>		ABBO, EB
Wood Thrush	<i>Hylocichla mustelina</i>	SAR	ABBO, NHIC
Yellow Warbler	<i>Setophaga petechia</i>		ABBO, EB
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>		2017-06 SV, ABBO, EB
Yellow-rumped Warbler	<i>Setophaga coronata</i>		ABBO, EB
HERPETILES			
American Bullfrog	<i>Lithobates catesbeianus</i>		ORAA
American Toad	<i>Anaxyrus americanus</i>		ORAA
Blanding's Turtle	<i>Emydoidea blandingii</i>	SAR	NHIC, ORAA
Blue-spotted Salamander	<i>Ambystoma laterale</i>		ORAA
Eastern Gartersnake	<i>Thamnophis sirtalis</i>		ORAA
Eastern Milksnake	<i>Lampropeltis triangulum</i>	SAR	ORAA
Eastern Musk Turtle	<i>Sternotherus odoratus</i>	SAR	ORAA
Gray Treefrog	<i>Hyla versicolor</i>		ORAA
Green Frog	<i>Rana clamitans</i>		ORAA, PCA
Midland Painted Turtle	<i>Chrysemys picta</i>	SAR	2017-06 SV, ORAA
Mink Frog	<i>Lithobates septentrionalis</i>		ORAA
Northern Leopard Frog	<i>Lithobates pipiens</i>		ORAA
Northern Map Turtle	<i>Graptemys geographica</i>	SAR	ORAA
Red-bellied Snake	<i>Storeria occipitomaculata</i>		ORAA
Red-eared Slider	<i>Trachemys scripta elegans</i>		ORAA
Snapping Turtle	<i>Chelydra serpentina</i>	SAR	NHIC, ORAA
Spring Peeper	<i>Pseudacris crucifer</i>		ORAA
Western Chorus Frog	<i>Pseudacris triseriata</i>	SAR	ORAA
Wood Frog	<i>Lithobates sylvaticus</i>		ORAA
MAMMALS			
N/A			
INVERTEBRATE			
Chinese Mystery Snail	<i>Cipangopaludina chinensis</i>	INV	EDM
Common Periwinkle	<i>Littorina littorea</i>	INV	EDM
Rusty Crayfish	<i>Orconectes rusticus</i>	INV	EDM
Zebra Mussel	<i>Dreissena polymorpha (Pallas)</i>	INV	EDM





FISH			
Black Crappie	<i>Pomoxis nigromaculatus</i>		FHA
Bluegill	<i>Lepomis macrochirus</i>		FHA
Bluntnose Minnow	<i>Pimephales notatus</i>		FHA
Brown Bullhead	<i>Ameiurus nebulosus</i>		FHA
Common Carp	<i>Cyprinus carpio</i>		FHA
Common Shiner	<i>Luxilus cornutus</i>		FHA
Iowa Darter	<i>Etheostoma exile</i>		FHA
Largemouth Bass	<i>Micropterus salmoides</i>		AA, FHA
Sunfish sp.	<i>Lepomis sp.</i>		FHA
Logperch	<i>Percina sp.</i>		FHA
Mottled Sculpin	<i>Cottus bairdii</i>		FHA
Muskellunge	<i>Esox masquinongy</i>		AA
Pumpkinseed	<i>Lepomis gibbosus</i>		FHA
Rock Bass	<i>Ambloplites rupestris</i>		FHA
Round Goby	<i>Neogobius melanostomus</i>	INV	EDM
Smallmouth Bass	<i>Micropterus dolomieu</i>		AA, FHA
Spottail Shiner	<i>Notropis hudsonius</i>		FHA
Walleye	<i>Sander vitreus</i>		FHA
White Sucker	<i>Catostomus commersonii</i>		FHA
Yellow Perch	<i>Perca flavescens</i>		FHA
INSECTS			
Monarch Butterfly	<i>Danaus plexippus</i>	SAR	2017-06 SV, SFO
Tent Caterpillar	<i>Malacosoma sp.</i>	NPS	2018-06 SV
VEGETATION			
TREES			
Apple sp.	<i>Malus pumila</i>		2017-06 SV
Balsam Poplar	<i>Populus balsamifera</i>		2017-06 SV
Basswood sp.	<i>Tilia sp.</i>		2017-06 SV
Black Locust	<i>Robinia pseudoacacia</i>	INV	2017-06 SV, EDM
Black Walnut	<i>Juglans nigra</i>		2017-06 SV
Boxelder Maple / Manitoba Maple	<i>Acer negundo</i>	INV	2017-06 SV, 2018-06 SV, EDM
Butternut	<i>Juglans cinerea</i>	SAR	NHIC, SFO
Choke Cherry	<i>Prunus virginiana</i>		2017-06 SV
Common Hawthorn	<i>Crataegus monogyna</i>		2017-06 SV
Eastern White Cedar	<i>Thuja occidentalis</i>		2018-06 SV
European Buckthorn	<i>Rhamnus cathartica</i> L.	INV	2017-06 SV, EDM
Jack Pine	<i>Pinus banksiana</i>		2017-06 SV
Norway Maple	<i>Acer platanoides</i>	INV	2017-06 SV, EDM
Eastern Red Cedar	<i>Thuja plicata</i>		2017-06 SV, 2018-06 SV
Red Maple	<i>Acer rubrum</i>		2018-06 SV
Red Pine	<i>Pinus resinosa</i>		2018-06 SV
Rock Elm	<i>Ulmus thomasii</i>		2017-06 SV
Scots Pine	<i>Pinus sylvestris</i>	INV	2017-06 SV





Speckled Alder	<i>Alnus incana</i>		2017-06 SV
Staghorn Sumac	<i>Rhus typhina</i>		2017-06 SV, 2018-06 SV
Spruce sp.	<i>Picea Sp.</i>		2018-06 SV
Tatarian Honeysuckle	<i>Lonicera tatarica</i>	INV	2017-06 SV, 2018-06 SV
Trembling Aspen	<i>Populus tremuloides</i>		2017-06 SV
White Ash	<i>Fraxinus americana</i>		2017-06 SV, 2018-06 SV
OTHER TERRESTRIAL VEGETATION			
Alfalfa	<i>Medicago sativa</i>		2017-06 SV
Barren Strawberry	<i>Waldsteinia fragarioides</i>		2017-06 SV
Bird's-foot Trefoil	<i>Lotus corniculatus</i>		2017-06 SV
Bladder Companion	<i>Silene vulgaris</i>		2017-06 SV
Coltsfoot	<i>Tussilago farfara</i>	INV	2018-06 SV, EDM
Common Buttercup	<i>Ranunculus acris</i>		2017-06 SV, 2018-06 SV
Common Goat's Beard	<i>Tragopogon dubius</i>		2017-06 SV
Common Lilac	<i>Syringa vulgaris</i>		2017-06 SV
Common Milkweed	<i>Asclepias syriaca</i>		2017-06 SV, 2018-06 SV
Common Mullein	<i>Verbascum thapsus</i>		2017-06 SV
Common Plantain	<i>Plantago major</i>		2017-06 SV
Common Rhubarb	<i>Rheum rhabarbarum</i>		2017-06 SV
Common Smoketree	<i>Cotinus coggygria</i>		2017-06 SV
Crown Vetch	<i>Securigera varia</i>		2017-06 SV
Dandelion sp.	<i>Taraxacum sp.</i>		2017-06 SV
Dames Rocket	<i>Hesperis matronalis</i>	INV	EDM
Daylily sp.	<i>Hemerocallis sp.</i>		2017-06 SV, 2018-06 SV
Dog Strangling Vine	<i>Vincetoxicum rossicum</i>	INV	2017-06 SV, EDM
Eastern Cottonwood	<i>Populus deltoides</i>		2017-06 SV
Garlic Mustard	<i>Alliaria petiolata</i>	INV	EDM
Giant Hogweed	<i>Heracleum mantegazzianum</i>	INV	EDM
Goldenrod sp.	<i>Solidago sp.</i>		2017-06 SV, 2018-06 SV
Harebell	<i>Campanula rotundifolia</i>		2017-06 SV
Japanese Knotweed	<i>Fallopia japonica</i>	INV	EDM
Little Bluestem	<i>Schizachyrium scoparium</i>		2017-06 SV
Multiflora Rosa	<i>Rosa multiflora</i>	INV	EDM
Northern Bedstraw	<i>Galium boreale</i>		2017-06 SV
New England Aster	<i>Symphotrichum novae-angliae</i>		2018-06 SV
Oxeye Daisy	<i>Leucanthemum vulgare</i>		2017-06 SV
Philadelphia Fleabane	<i>Erigeron philadelphicus</i>		2017-06 SV
Purple Cow Vetch	<i>Vicia cracca</i>		217-06 SV, 2018-06 SV





Red Clover	<i>Trifolium pratense</i>		2017-06 SV, 2018-06 SV
Red Osier Dogwood	<i>Cornus sericea</i>		2017-06 SV, 2018-06-SV
Smooth Bromegrass	<i>Bromus inermis</i>		2017-06 SV
Spike Rush	<i>Eleocharis palustris</i>		2017-06 SV
Sulphur Cinquefoil	<i>Potentilla recta</i>		2017-06 SV
Switchgrass	<i>Panicum virgatum</i>		2017-06 SV
Tall Fescue Grass	<i>Festuca arundinacea</i>		2017-06 SV
Thistle sp.	<i>Cirsium sp.</i>		2018-06 SV
Timothy Grass	<i>Phleum pratense</i>		2017-06 SV
Viper's Bugloss	<i>Echium vulgare</i>		2017-06 SV
Virginia Creeper	<i>Parthenocissus quinquefolia</i>		2017-06 SV
White Clover	<i>Trifolium repens</i>		2017-06 SV, 2018-06 SV
White Sweet Clover	<i>Melilotus albus</i>		2017-06 SV
Wild Carrot	<i>Daucus carota</i>		2017-06 SV
Wild Catnip	<i>Nepeta cataria</i>		2017-06 SV
Wild Grape Vine	<i>Vitis vinifera</i>		2017-06 SV, 2018-06 SV
Wild Parsnip	<i>Pastinaca sativa</i>	INV	EDM
Wild Rose sp.	<i>Rosa sp.</i>		2017-06 SV
Wood Sorrel sp.	<i>Oxalis sp.</i>		2017-06 SV
Yarrow	<i>Achillea millefolium</i>		2017-06 SV
Yellow Sweet-clover	<i>Melilotus officinalis</i>	INV	2017-06 SV
AQUATIC VEGETATION			
Cattail (Bulrush) sp.	<i>Typha sp.</i>	HX? INV?	2017-06 SV
European Common Reed	<i>Phragmites australis</i>	INV	EDM
European Frog-bit	<i>Hydrocharis morsus-ranae</i>	INV	EDM
Purple Loosestrife	<i>Lythrum salicaria</i>	INV	EDM

AA = Angler's Atlas

CH = Critical Habitat (within proximity of site)

COSEWIC = Committee on the Status of Endangered Wildlife in Canada

EDM = EDDmaps

FHA = Fish Habitat Assessment Report 2017

INV = Invasive Species

NPS = Noxious/ Pest Species

SAR = Species at Risk

SV = PCA Site Visit

ABBO = Atlas of Breeding Birds of Ontario

EB = eBirds Hotspots – L5726431 (~350 m)

EX = Exotic

HX = Hybrid

NHIC = National heritage Information Centre

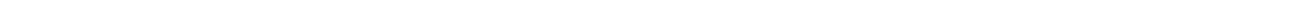
ORAA = Ontario Reptile and Amphibian Atlas

SFO = SAR Field Observation



APPENDIX D

ARCHAEOLOGICAL OVERVIEW ASSESSMENT





**PARKS CANADA AGENCY
ARCHAEOLOGY AND HISTORY BRANCH
INDIGENOUS AFFAIRS AND CULTURAL HERITAGE DIRECTORATE**

**ARCHAEOLOGICAL OVERVIEW ASSESSMENT
REHABILITATION OF WARSAW ROAD SWING BRIDGE
TRENT-SEVERN WATERWAY NHSC
PETERBOROUGH, ONT**

Dina KALLAS
Terrestrial Archaeologists, IAHCD
National Office, Gatineau

ABSTRACT

Parks Canada Agency has proposed to rehabilitate Warsaw Road Swing Bridge on the Trent-Severn Waterway NHSC. This Archaeological Overview Assessment will evaluate the archaeological potential of the Project Area(s) and determine if an Archaeological Impact Assessment and/or mitigation measures are required for the Project.

HISTORICAL BACKGROUND AND PROJECT INTRODUCTION

Warsaw Road Swing Bridge is located on Parkhill Road East in the city of Peterborough in central Ontario and crosses over the Trent Severn Canal (Figure 1). This Road Swing Bridge was originally built in 1956, and it is an outstanding example of a typical plate girder swing bridge.

Parks Canada Agency (PCA) has proposed to replace the Warsaw Road Swing Bridge in order to increase the current down rated capacity to meet loading requirements and codes (PCA 2018:1). Work will include the replacement of the steel superstructure of the bridge; the rehabilitation of the concrete abutments, the pivot pier, and the approach slabs; and the removal and installation of a new mechanical/electrical operating system (Figures 2-3).

ARCHAEOLOGICAL POTENTIAL

No terrestrial archaeological investigations have been conducted within the Project Area. Recent maps and photos of the swing bridge and its vicinity illustrate that part of the area northwest of the swing bridge was built up while constructing the gatehouse and the area north of the gatehouse is a parking lot, indicating that these particular areas are disturbed (Figure 4-5).

Also, the presence of the canal walls, the wing shaped gate structure in the canal walls north of the swing bridge, and the riprap treatment along the west bank south of the swing bridge indicate that these areas have been altered when these features were constructed. Although limited, there still is potential for the presence of features related to the construction of the canal and/or earlier Indigenous occupation(s) of the area (Figure 4-6).





ASSESSMENT OF PROPOSED DEVELOPMENT IMPACTS AND ARCHAEOLOGICAL MITIGATION MEASURES

The present AOA is based on a review of the historical mapping and imagery available. Impacts from construction activities could impact potential archaeological resources unless the following mitigation measures are employed for the Project:

1. All work must occur within the area as originally designed and that was reviewed for this AOA. Should the location of the staging areas and vehicular access routes be modified and/or additional staging areas or access routes be required, forward additional information to the Terrestrial Archaeology section for review.
2. Main vehicular access routes and staging areas will be restricted to present-day roadways and parking lots. If this is not possible, the use of protective covering such as a geotextile protective covering with a wood chip lift or granular “A” gravel is required. All protective covering must be removed following construction and the area restored to pre-construction state. Excavation is not permitted during installation or removal of protective covering.
3. As per the Ontario Heritage Act and the Ministry of Tourism, Culture and Sport, a Stage 1-2 Archaeological Assessment is required for all Project lands not under federal jurisdiction. The recommendations from the Stage 1 Archaeological Assessment, or subsequent assessments, are to be complied with in conjunction with this AOA.
4. If unrecorded archaeological resources (e.g. structural features or artifact concentrations) are encountered during construction activities, work must cease in the immediate area, and the Parks Canada Project Manager be informed. The Project Manager will contact Parks Canada's Terrestrial Archaeology section for advice and assessment of significance, which will in turn determine what will be required to mitigate the find.

REFERENCES

Parks Canada Agency (PCA), 2018. Statement of Cultural Resource Impact Analysis for Warsaw Road Swing Bridge #27 Rehabilitation Project, Trent-Severn Waterway, ON (RPA 859), Prepared by Nathalie Desrosiers, Policy Advisor, Cultural Heritage Policies Branch, IACHD, Parks Canada, 12 June 2018.

Parks Canada Agency (PCA), 2019. Trent-Severn Waterway National Historic Site - Warsaw Road Swing Bridge Replacement, Parks Canada website:
<https://www.pc.gc.ca/en/lhn-nhs/on/trentsevern/visit/infrastructure/peterborough/pont-tournant-warsaw-road-swing-bridge>, accessed on 29 September 2019.

SNC-LAVALIN, 2019. Rehabilitation of Warsaw Road Swing Bridge, Trent-Severn Waterway, Peterborough, ONT. Parks Canada project no. R.30027479. Tender drawing designs issued for review on 11 July 2019.



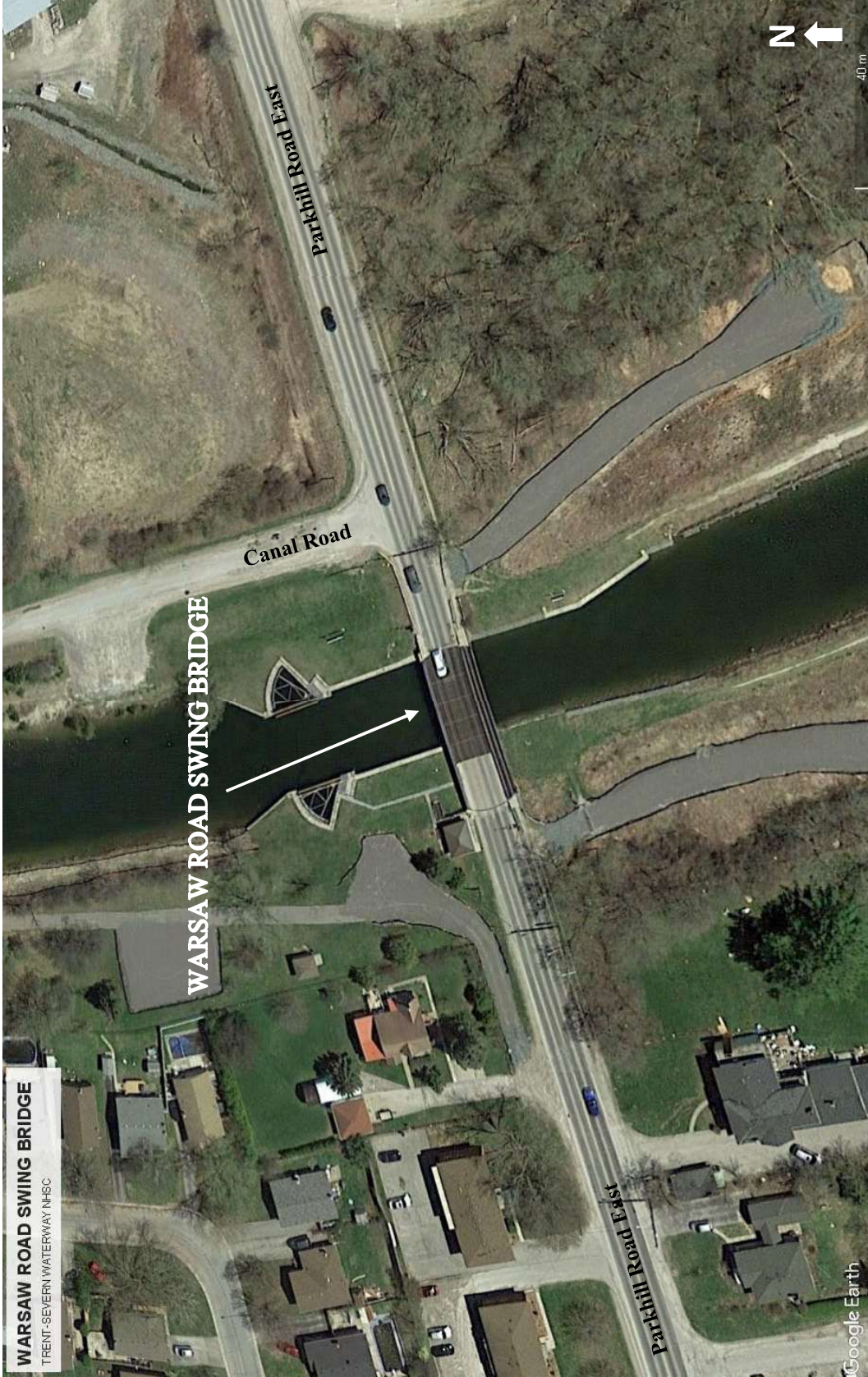


Figure 1. General view of Warsaw Road Swing Bridge (Google Earth accessed 24 September 2019).
25 September 2019



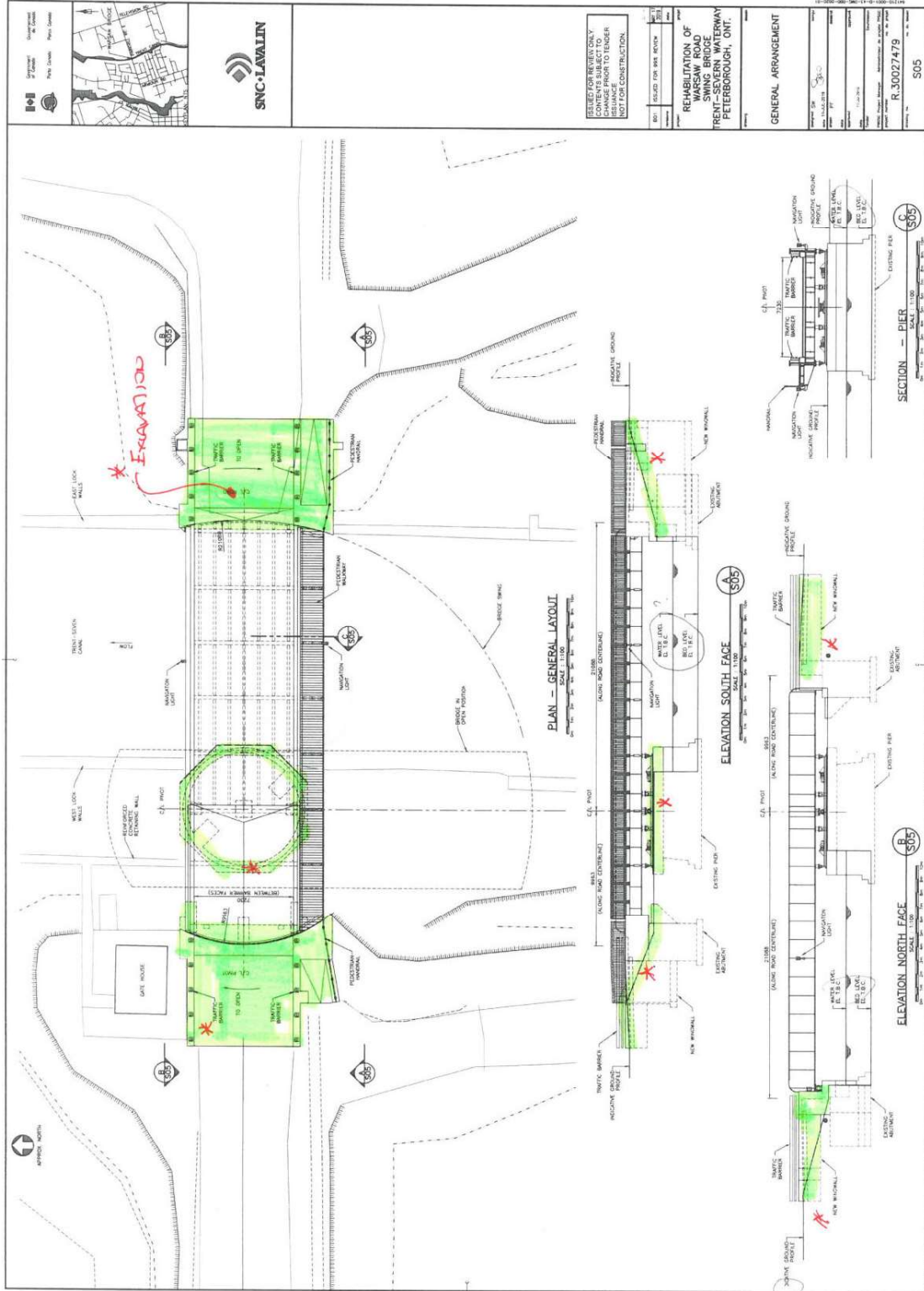


Figure 3. The general arrangement of the proposed project (SNC-Lavalin 2019; Drawing # S05). The areas to be excavated are highlighted in green.

25 September 2019



Figure 4. Warsaw Road Swing Bridge looking southeast (PCA 2019). Note that the area northwest of the swing bridge was built up while constructing the gatehouse. Also note the riprap treatment that covers the west bank south of the swing bridge to the bottom left of the picture.



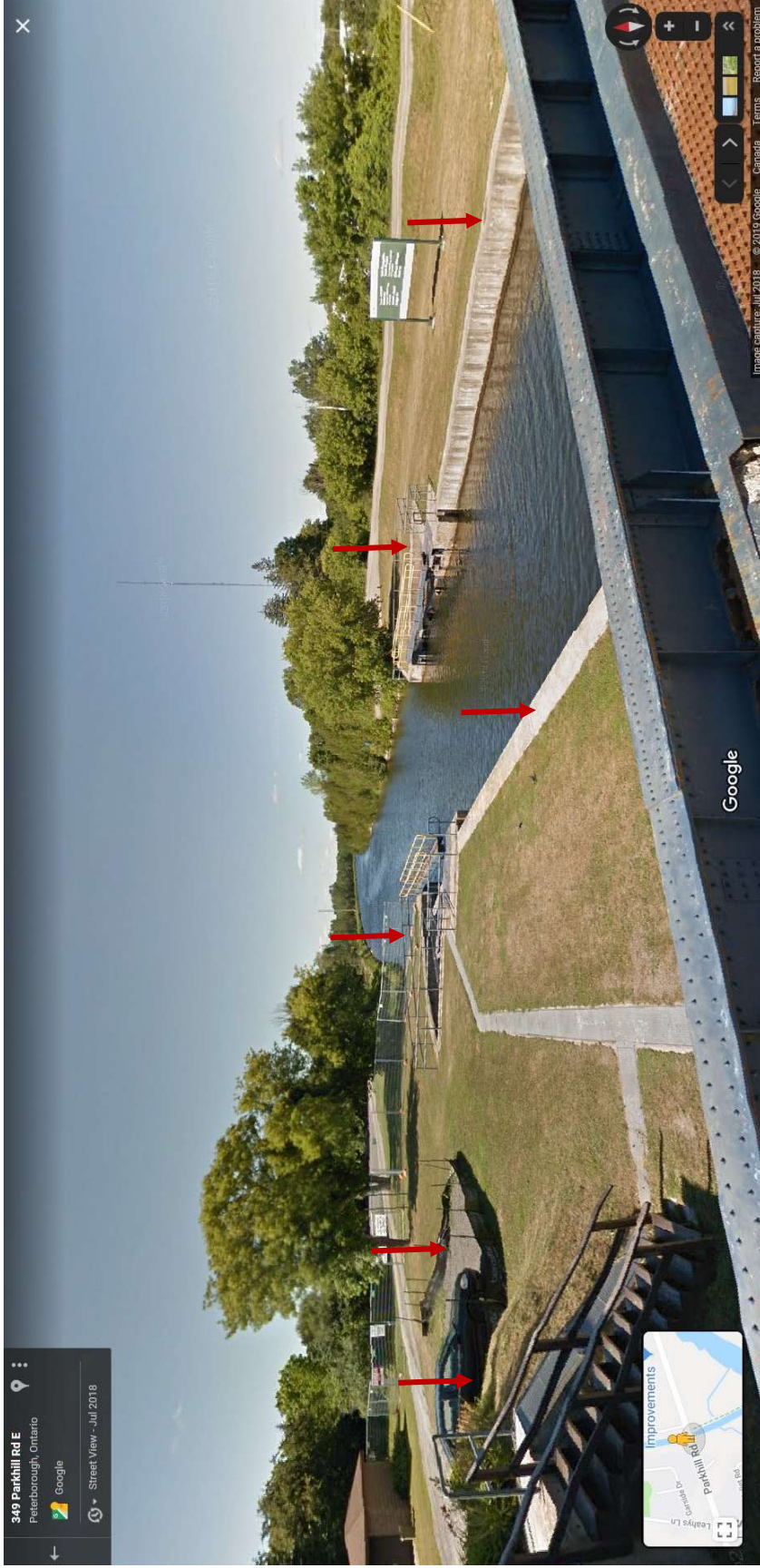


Figure 5. Looking north to Trent-Severn Canal from Warsaw Road Swing Bridge (Google maps, accessed on 25 September 2019). Note the built up area northwest of the swing bridge in the bottom left of the photo, the parking lot north of the Gate house, the canal walls, and the wing shaped gate structure in the canal walls.

25 September 2019

7





Figure 6. Looking south to Trent-Severn Canal from Warsaw Road Swing Bridge (Google maps, accessed on 25 September 2019). Note the canal walls, and the riprap treatment that covers the west bank immediately south of the swing bridge on the bottom right of the picture.

25 September 2019

8



APPENDIX E

SITE-SPECIFIC DESIGNATED SUBSTANCE AND HAZARDOUS
MATERIALS SURVEY REPORT

(to be provided by PCA)
